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CONTENTS

Industrial-Arts Adjustment Possibilities and Vocational Education, *by Roy A. Hinderman* 263
Opportunities for Historical Studies in Industrial-Arts Education — IV, *by L. F. Ashley* 266
Theory and Practice, *by Donald M. Kidd* 268
Guidance — the Shop Teacher's Responsibility, *by Claude F. Turner* 269
Progress Chart for the Millroom, *by R. A. Hicks* 270
Editorials 272
Teaching Aids, *by Wayne P. Hughes* 274
Accuracy in Mechanical Drawing, *by Stanley S. Radford* 276
Printing in the Junior High School, *by Frank Di Giacomo* 279
Operation Sheets Prepared by the Student, *by Hirschel M. James* 280
Teaching the Job Case to Young Students, *by C. K. Lush* 281
Why Copy?, *by August Flam* 282
A Desk Set in Copper — I, *by Leon H. Baxter* 283
Extracurricular Activities, *by F. N. Newton, Jr.* 288
Safety Rules for the Printshop, *by E. Pieri* 288
Sheet-Metal Gauges and Their Use, *by Lee M. Klinefelter* 289
Casting in the Schoolshop — IX, *by N. A. McMillan* 291

Testing and Tests

Junior-High-School Woodworking Test, *by H. L. Stiles* 292

Problems and Projects

Simple Book Ends, *by Ralph M. Merry* 294
Patterns for Wood Turning, *by Deane E. Eldridge* 294
Desk, Radio, or End-Table Lamp, *by S. H. Puehler* 295
Machinist's T-Tap Wrench, *by B. K. Beauchamp* 296
Duplicate Bridge Board, *by Felton L. Harlan* 297
Reboring a Hole to a Larger Diameter, *by Carl von Lindeman* 297
Paint Bench and Brush Holders, *by Don L. Olson* 297
Metal Tinning, *by Harry M. Dexter* 298
Oak-Leaf Desk Lamp, *by Carleton F. Spencer and Amos G. Williams* 299
Candleholder, *by Donald Towle* 300
Metal Picture Frames, *by H. M. Andersen* 300
Modernistic Combination End Table, Bookshelves, and Magazine Holder, *by Malcolm T. Howell* 301
Tin-Can Wheels for Toys, *by Jos. J. Lukowitz* 302
Kant-Stra Crochet Cotton Holder, *by Frank Judish* 302
Display Rack, *by G. A. Yeager* 302
Lamp, *by R. A. Tomkiewicz* 304
Some Uses for Wrapping-Paper Core Spools, *by Frank Bentley* 305
Device for Repairing T-Square Blades, *by H. J. Bauman* 305
Indian Ladles, Bowls, and Drinking Cups, *by W. Ben. Hunt* 306
A Practical Modernistic End Table, *by S. H. Puehler* 307
Portable Tool Rack, *by Wilbur Hilliard* 307
Round Tray, *by William J. Becker* 307
Resurfacing an Oilstone, *by A. C. Andrews* 11A

Posters

Leadership, *by Louis M. Roehl* 307
A Self-Starter, *by Louis M. Roehl* 308

Supplement

Elements of Industries, *by Geo. C. Decker* ..... No. 345

Answers to Questions 11A
Association News 12A
Personal News 12A
New Publications 15A
News Notes 18A
School-Shop Equipment News 25A

WERE WE WRONG?

Since the inception of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine, it has been our policy to supply, as part of our subscription service, twelve monthly issues. During the depression, when the regular issues of the paper were again and again showing a pathetic loss, we continued the old policy. The question whether the summer issues are actually used by the reader arose, however, and a study of the reading habits of our subscribers was made.

With the splendid summer courses offered by teacher-training institutions to shop teachers, it is not strange at all that many of our readers spend at least part of their vacation either teaching or taking advanced courses. But the fact remains that the greatest number of them are not at home when the July and August magazines arrive. Then, too, advertisers assert that the value of the advertising is deferred to September and October and loses some of its immediate time value.

Facing the issue frankly, then, we have concluded that four to eight additional pages in each issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION spread over ten issues of the magazine will give the subscriber a superior editorial service. We are convinced this solution of our problem will not only mean a bigger and a better magazine, but the editorial service will come during the vital winter months of the school year when every teacher is on the job.

We sincerely hope that our readers will like this change. All subscriptions this fall will be dated on a ten-month period. We shall not increase the subscription price, but we shall strive to give you a better paper.

FRANK BRUCE
Publisher

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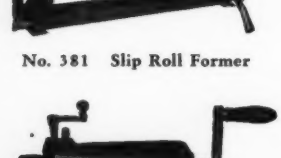

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

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Industrial-Arts Adjustment Possibilities and Vocational Education

Roy A. Hinderman
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What modern civilization demands from the youth now passing through our schools.

Persons who achieve successful vocational adjustment are those who possess two elusive characteristics. These two qualities are versatility and adaptability. Sudden and continuous technological change with the attendant disappearance of old established vocations, a shifting of emphasis from production to distribution, and the emergence of new types of work, tax even the most agile mind and body.

It has been reported in many publications that the emotional resistance to change is probably as potent a factor in continuing the unemployed state of many persons as is the attendant lack of skill. The adjustment picture may appear more realistic if some conclusions are presented from a recent occupational trends study.[1]

Personal adjustment qualifications are summed up as follows:

1. "Employers stress the importance of social experience which prepare for living, working, and playing with others. Play is the foundation of a joyous, well-rounded, healthful life. The individual who will be in demand is one who can get along successfully with other persons, since employers believe social intelligence is to be an increasingly important factor in future vocational success.

2. "They suggest that more be done in having student's attitudes reflect the fact that life, although interesting, likewise is a serious affair, success in which demands much resourceful effort.

"Such present-day shortcomings as poor self-control, discourtesy, dishonesty, and a lack of dependability should be overcome, they insist, by stressing the great indispensability of these necessary qualities in both social and occupational life.

3. "In addition, each employer indicated some concern about such essential qualities as openmindedness, loyalty, natural humor, and neatness of person and dress.

"In general, employers indicate fully as much concern about the control of emotions while at work as they do about the control of motions."

[1]Edgerton, A. H., *Occupational Trends*, University of Wisconsin, 1936.

Emotional Control

The problem of emotional control is a very interesting one and has been the subject of extended researches over a long period of time. Hersey[2] found that the emotions of normal individuals run in regular cycles of about five-week periods which range from a somewhat pessimistic state to one of a relatively joyous condition. It is also true that all persons reach their highest emotional plane in October and the lowest ebb in March. An analysis of different kinds of work show that jobs which require continuous attention, or those that are practically automatic, are the most gratifying; while those that require intermittent attention are most distressing and lead to emotional instability.

While problems arising from leisure, home life, sex, and finance at times condition the emotional state of workers, it has been found that successful achievement on the job is the most important factor in vocational adjustment. No matter how nearly black things may look today, it seems important to note that just as summer follows spring so it is also true, the brighter side will reappear in its regular course.

It is apparent then that emotional balance is a very important aspect of vocational adjustment and that careful job selection plus a knowledge of human emotional cycles are important to every breadwinner who would get the most out of life.

Educational Qualifications

A second phase of adjustment has been summarized under the caption of educational qualification:[3]

1. "Other qualifications being equal, a college graduate has a far better chance of placement and of advancement than one without college training.

"Notwithstanding past reported practices, one well trained in liberal arts and sciences, plus basic thinking, is now to have some advantage over the too technically trained and specialized candidate.

2. "Employers advise young persons to come to them basically trained, but ready to receive special preparation 'on the job.'

"They definitely specify problem-solving ability, the use of correct English, a knowledge of public speaking, and legible handwriting for positions in which these are certain to affect graduates entering employment.

3. "Because of the many-sided demands at present it is suggested that at least a double vocational objective may be helpful for some time to come.

"The employers sound a warning to those who fail to improve themselves while unemployed since they first ask: 'What have you been doing during the past few months?'

"The challenge which has been presented to youth under educational qualifications for work is very definite. The relationships between study and success should be clearly understood and youth should do something about it by continuous learning before and after employment. A rich background is a necessity in understanding rapid technological change and advancement.

Job adjustment qualifications which were earlier referred to are summarized in these statements:[4]

1. "In general, it seems that employers look for persons who have a reasonable degree of initiative; those who can solve their own problems if need be, and who can be depended upon to carry out instructions at all times.

"They insist that a lack of experience is secondary to the advancement possibilities of the graduate; the most important factor

[2]Hersey, R. B., *Workers' Emotions in Shop and Home*, Chapter V, University of Pennsylvania Press, 1932.

[3]Edgerton, A. H., *Occupational Trends*, University of Wisconsin, 1936.

[4]Edgerton, A. H., *Occupational Trends*, University of Wisconsin, 1936.

being his willingness to work diligently and learn through patience, advice, and observation.

2. "The future employee will be expected to prepare for and do well two or three different kinds of work rather than one very specialized type as has been the case in the past.

"Furthermore, employers expect the young employee to enter on the learning level and to remain there long enough to acquire perspective as well as skill and knowledge.

3. "Actual placement promises to become more difficult, since a higher level of preparation is being asked for by employers, and everyone concerned will need to strive harder for successful wage-earning adjustment, with somewhat less satisfactory results than formerly.

"They state they will judge employees for promotion by their continued interest, achievements, and general growth in work assigned.

"Finally, several employers seriously believe that, for the present, the standardization tendency in large power or oil companies, telephone or telegraph systems, chain stores or newspapers, and governmental agencies (post offices, etc.) have placed definite limitations upon freedom of opportunity and individual initiative. Youth should consider these conditions in their future vocational plans as long as they continue to exist. Employers (large and small concern representatives alike) would have future employees explore varied possibilities in small and local businesses, including family interests or firms. They refer to enterprises dealing with creative ideas in science, art, mechanics, literature, electricity, and merchandizing, which capitalize on personal growth, courage, and character. Employers agree that the beginning position or salary is of minor importance to youth, but point out that the young worker's attitude and interest at this period are significant to his future success."

Problems Confronting the School

The brief summary of vocational adjustment problems which confront youth emphasizes the importance of a carefully planned and extended period of education. Economic conditions have raised the age of entering work to twenty or twenty-five for most individuals and correspondingly the high-school enrollment includes from seventy to ninety per cent of the boys and girls of high-school age. It is a distinct advantage to have the pupils in school for a longer period of time because a complete educational program can be planned for them. The fact remains that the traditional subjects that were uninteresting to them when work was plentiful have not automatically become interesting to them now. If the needs of this group are to be met, new areas must be developed. Since much of the subject matter which formerly failed to appeal to them was abstract, the challenge to some of the more functional subjects like industrial education is clear. Before considering some of the new areas in industrial arts it may be interesting to examine the change in emphasis in a complete program designed for articulation and adjustment.

In most instances industrial arts has lost its separate identity in the elementary school to become an integrated part of the experiences of pupils in the form of construction work that gives reality to concepts and understandings. It becomes the basis for learning about the world's work in terms of raising and preparing food, building and buying shelter, and manufacturing and selling clothing. Understanding is enhanced and pupils are elevated to participate on a higher social plane.

Because of the diversity of articles of industry the problem of consumer education is being given special consideration at the junior-high-school level as a very important aspect of industrial-arts instruction. It appears that the program of rather superficial exploration which dominated the earlier junior-high-school work is being shifted to more intensified exploration at the senior-high-school level.

Industrial intelligence which includes the development of a background of industrial information, sensitivity to significant problems in the mechanical environment, and the acquisition of appropriate attitudes, is a new development of the high-school program. The articulation of high-school preparation and vocational training programs requires the co-operation of industry with the schools. Such programs as apprenticeship, co-operative education, and occupational internship appear to be the connecting links in completing the adjustment of future wage-earning groups in skilled and semi-skilled vocations.

An example of the search for mechanical skill by a leading mid-western clinic may be of interest here. The night before Halloween a large group of boys, enrolled in the industrial-arts classes, were guests of Dr. Jackson in his clinic. When the group had assembled it was taken through dimly lighted rooms, containing many grotesque displays of skeletons, embalmed arms and legs, and petrified skulls, to a projection room to see a film of accidents which took place on the field of sport, in the home, and in traffic. This was followed by a most interesting display of the bone surgery which followed each accident. Beautifully fitted butt, dovetail and lap joints in bone secured by German silver inserts, and carefully attached braces secured with screws and dowels, were explained. The group then convened in the operating room to inspect mallets, chisels, saws, drills, elevators, pincers, and even taps and dies which are called into daily use by the bone surgeon.

After examining these tools many of which had been designed and improved by the surgeons, the new operating and obstetric tables as well as the non-shadow operating lamps were inspected by the group. Lastly the radio knife was discussed. By turning one button a cutting current was called into use with which incisions are made and then another button was turned to release a frying current in the point of the knife. The opening of a wound is gently closed and when the skin is placed in the correct position the knife is touched to the incision at regular intervals to fry the flesh together. This operation takes the place of catgut and stitches in modern surgery.

Dr. Jackson concluded by saying that the medical profession needs persons with mechanical skill and understanding, and that in the high-school industrial-arts work, boys may secure the much needed knowledge.

While much attention has for years been given to the development of mechanical skills in industrial-arts work, the rapidity of technological advancement is calling for emphasis on the side of understanding. It seems that related understanding is a step toward versatility. Even though the cry of technocracy has subsided and we still are using money as a medium of exchange, new inventions are continuing to be introduced in society at an appalling rate. I was really shocked about three years ago when I found that an acquaintance of mine was being paid to control the steel formula of razor blades so that they would lose their edge after they had been immersed in water for a minute and a half.

It would seem important that boys should know of developments like the following:

1. Forty-three per cent of all steel is produced in sheets on rolling mills one half mile long, which cost twenty million dollars each.

2. Eighty-three different kinds of steel are used in building automobiles.

3. Bobby-pin wire is made in four hundred and fifty shapes, thicknesses, widths and finishes to satisfy the whims of ladies.

4. Activity in the steel industry is at the 1929 peak, while fifty per cent as many men are employed in production and fifty per cent more in distribution than before the depression.

5. Flashing lamps five minutes off and five minutes on make plants bloom all year around, while special insulation makes hothouse vegetables as rich as garden varieties because of a new humidity.

6. One pound of molten glass can be spun into a thread that would reach around the earth and women's complete costumes are being made of glass cloth.

7. Glass alone is being used in new buildings with eighty-foot towers and glass has been found to be an excellent road surfacer.

8. Safety glass is seventy per cent stronger

because it bends under an impact and then springs back again.

Intelligent Consumption

The foregoing examples illustrate a type of information which persons must have if they are to make intelligent decisions. Without an industrial background the best one can do is to guess.

The boy makes important use of this background in buying and appreciating industrial products. The high-school boy has just recently been permitted to drive the family car and in many cases has begun to receive an allowance for the first time. These two conditions make him a full-fledged consumer of industrial products. The problems involved in buying wisely are by no means simple, and as we all know the rigorous analysis which includes a consideration of utility, beauty, and service, vex many seasoned adults. It is probably true that of the millions of people who attended automobile shows recently, by far the greater proportion were confused rather than enlightened. Such terms as molybdenum, center poise steering, sway stabilization, electric hand, overdrive, supercharger, and horizontal aerodynamics are only a few of the things to be understood and gisted in a brief period of two hours. It is with this problem of careful consumption that industrial-arts courses familiarize our boys and girls. Problems like those encountered in choosing an automobile are to be found in buying electrical appliances, tools, water softeners, furniture, cottages, and camping equipment. Consumer education is at once opportunity and a challenge to the industrial arts.

Leisure and Its Use

The profitable use of leisure depends in a large measure on a varied background of interesting experiences. Such a diversified pattern of understanding can be enlarged by participation in industrial-arts courses. Tom Coleman was a boy who really enjoyed working with clay, color plastics, Keene's cement, and tile and was always disappointed when he could no longer find new plastics with which to work. On a day in May last year a university geologist in Tom's home town was making up an expedition which was destined for famous old ruins in the interesting country of Mexico.

In casting about for personnel for the group the geologist chose Tom because of his interest and skill in ceramics, and Tom, to say the least, was feverishly excited. There were things to pack, they would work below sea level where humidity is high, the natives would no doubt fail to understand them and so and on as the preparations progressed.

Finally they reached the ancient ruins and after six weeks of digging and fruitless effort Tom found three quarters of the head of a small sphinx. Carefully guarding his treasure he expertly fashioned the broken portion of the head and received one hundred and fifty dollars for his fine work.

Tom has frequently entertained a group of people for several hours with descriptions of the expedition and he is an exceedingly interesting person to visit.

This case illustrates a fine leisure outlet in industrial arts not alone through increasing interest in making things but also in opening so many new interest doors which hold new thrills and excitement perhaps more alluring than any of the old stand-bys.

Knowledge of Industry

As the pupil develops an industrial background, and adds to it skill in wise buying plus some new leisure interests, he becomes more sensitive to significant problems. The first time a boy learns to identify a certain sound which comes from the auto on cold mornings with the fact that pistons are slapping, his sensitivity has been increased. Next time the relationship should be established by the boy.

It seems important for a boy to understand that when the odor of gas is noticed in the kitchen that all valves on the gas range should be turned off, and then if the odor continues, a test should be performed. The test is by the soap-bubble method rather than with a flame. Again it may be that the camp stove fails to burn after fuel is put into the tank. A boy should know that burners must be cleaned and the generator must be unstopped.

Again in the realm of employment boys should understand the seasonal aspect of building trades, of working on boats on the great lakes, of mining coal, and of the painting and decorating trade. They should likewise be aware of the growing fields of ceramics, metallurgy, air conditioning, and prefabricated housing if they are to choose wisely their entrance into occupations.

This sensitivity is produced in boys by helping them see relationships in enough different situations so that they develop the skill of discovering the relationships for themselves. Industrial-arts courses offer splendid opportunities to assist boys and girls in becoming sensitive to significant problems.

A carefully conducted program of industrial education prepares a boy by developing in him an industrial background, a sensitivity, and interests which make it possible for him to choose his future vocation in a considered manner. The difficulty of choosing a field of work and preparing for it is clearly illustrated by the fact that most jobs require a combination of several things.

Draftsmen must double at show-card writing, electricians must know something about air conditioning and insulation, and boilermakers, sheet-metal workers, steam fitters, and auto mechanics are required to understand welding.

If you want to see an interesting picture, step into any night-school welding class and observe the looks of determination on faces of men in an overcrowded room. In many cases they stand gladly for two hours after a hard day's work so that they too may meet the new type job specifications.

Another example from the field of telegraphy. An interview with superintendents of three large Midwestern railroads revealed the fact that while Morse operators are without work there is a scarcity of competent telegraphers. In fact, the shortage is so severe that railroad companies are raising age levels to seventy-five, they are omitting physical examinations, and they are scouring the country for men. The difficulty is that operators must know Morse, be able to run the new printers, understand train orders, and be skilled in the routine of station practice, such as, way billing, selling tickets, and making freight claim adjustments.

Industrial-arts courses have the opportunity to aid boys with their problem of getting ready to choose a lifework by developing in them understandings and attitudes which place choice making above the plane of guesswork. At that point in the light of present information, vocational education through co-operative programs of apprenticeship, companionate education, or occupational internship, can prepare boys for broad vocational fields. This broad preparation takes long periods of time, but means enlarged returns to individuals because of their greater versatility and adaptability in society.

A corner in the finishing-room at the Peckham Vocational High School of Buffalo, New York

Opportunities for Historical Studies in Industrial-Arts Education—IV

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This is the last of a series of four articles on industrial-arts research.

Someone is said to have remarked plaintively, "All of my best ideas were stolen by the ancients." The thought implied arises frequently in the mind of the student of history and he is often aghast at the discovery that ideas which he has considered new, were common knowledge very long ago. This thought is seen in the words composing the title of a modern play, "The Greeks Had a Word for It." Good[1] has often pointed out that all that is really new in education is the discovery of new applications or uses for old ideas.

It would seem from these statements that there can be little use for historical studies if all that one can find only echoes what we already know. The contrary, however, is true. "The keynote of history is development," says Vincent and knowledge of the steps in the evolution of an educational theory not only shows how it was built up but suggests to the student possibilities for improvement along the way, and at the same time points to new applications and uses of former ideas. An analogy is seen in the evolution of inventions. Through a constant application of the ideas developed in the transmission of motion, the ultimate in efficient machinery is reached. A study of old models shows where the need for improvement came in and suggests at different stages the possibilities of newer and better products.

The field for historical studies in which the student of industrial-arts research can put forth profitable effort may be divided into two large major areas: (1) studies in professional ancestry which have to do with ideologies, theories, or patterns, great schools, great educational movements, legislations and subsidies, great men, and nomenclature; and (2) studies of the material heritage, such as those pertaining to archeological investigations regarding Oriental, Egyptian, Greek, Roman, and other nations and places. Such studies also include inventions, discoveries, and conventions, especially as the latter applies to style. For example, the Spanish Renaissance as compared with modern.

Ideologies set up for industrial-arts education can scarcely be separated from those of general education, though one finds attempts at making such segregation in its development. A brief overview of the scope of this area of study may be found in chapters five and six of *A Prospectus for Industrial Arts in Ohio*.[2] Here attention is called especially to the writing of Charles A. Bennett in his book, *A History of Manual and Industrial Education up to 1870*, where one may trace many of the research topics mentioned in this paper.

The earliest notions that one gets of educational values, as well as of society in general, are probably found in the writings of the ancient Jews, such as *The Talmud* and *The Code of Hammurabi*. This ancient Code was translated by Dr. Robert Francis Harper, professor of semitic languages at the University of Chicago. The second edition was published in 1904. The student is taken back 2,250 years before Christ, and the 282 laws are not only interesting reading but shed much light on the origins of modern customs. The mention of handicrafts in at least two instances conveys an idea of the place they occupied in an ancient social order. Space here permits mention of but a few of the major divisions in educational thinking as they apply chronologically to areas for research in industrial-arts education.

Coming down from the period of ancient Jewish writings, the student will find considerable of interest relative to the period designated by some writers as that of the ancient Greeks. This starts about 500 B.C. and includes three or four hundred years of time. The writings of Plato, Aristotle, and Socrates are most characteristic, and there is much yet to be done to bring to light all that is of significance to industrial arts in their writings.

There are really two periods in the ancient Greek philosophy which need study. One is that period in which the Persian domination caused all teaching to be along lines for the benefit of the state. The other is that period after the Persian yoke was thrown off, and which is characterized by an emphasis on individual values.

The period immediately following the overthrow of Greece by Rome and lasting three or four hundred years A.D. is practically virgin territory for much exploration in industrial-arts research. There is plenty of evidence of the Roman knowledge of use of handicrafts. The Romans were a practical people and had made great strides in what we now call civil engineering. The practical work, however, was done by slaves, and education for the Romans seems to have been little different from that of the Greeks; namely, greater proficiency in such studies as would make powerful leaders and orators, politicians, or theologians.

Following the period in which Rome was at its glory, there are a thousand years during which all learning seemed to have been lost. This is the period dominated by the German tribes and lasting nearly to the sixteenth century. This long period has been practically untouched by industrial-arts students. Perhaps the greatest treasure to be uncovered in this period will be in the material heritage. Studies in the work of the monks and church scholars in preserving and translating the writings of ancient Greece and Rome; their efforts in bookmaking; their manner of living; the place of the handicrafts in their lives; are a few of the possibilities for students in this period.

Ideologies developing with the Renaissance in the twelfth century had much to do with the introduction of vernacular schools. This period will furnish material relative to beginnings in the common school development, and in so-called practical education. Chivalry was at its height at this time, and it is significant to the student in industrial-arts education that an important factor in the great social change taking place was the practical knowledge derived from contacts made by the pilgrims and crusaders with the material cultures of the Far East. What was learned of methods in architecture, bridge building, road making, and metal crafts did much more to impress the thirteenth century with the need for general and practical knowledge than did the orations of Cicero, so carefully resurrected at the time.

The invention of printing in the fifteenth

[1]Good, Harry G., Professor of the History of Education, Ohio State University, Writer on Historical Research.

[2]Skinner, B. O., and Collicott, J. G., *A Prospectus for Industrial Arts in Ohio*. Columbus, Ohio, State Department of Education, 1934. See pages 38–51. (William E. Warner, Managing Editor, and Coauthor.)

century made it possible for Luther's doctrines to be quickly spread over Europe. As a basis for the social realism of the seventeenth century, there is room for interesting studies in this connection. Studies in the life and works of Mulcaster, Bacon, and Comenius will uncover the basic philosophy of the social realists who followed them.

The ideologies of the social realists may be characterized by Milton's famous definition of education in which he said, "I hold, therefore, complete and generous education, that which fits a man to perform all the offices, public and private, justly, skillfully, and magnanimously, in peace and in war." This idea is echoed by Petty, Hartlib, and Locke, in their practical and literary efforts.

The period following, and designated by some writers as the beginning of psychology and by others as the period of sense realism, is represented by Rousseau, Pestalozzi, Froebel, Herbart, and contemporaries. Manual work is advocated as a background of experience necessary for new knowledge. The early part of the nineteenth century saw industrial arts developing both as a method in the teaching of other subjects and as a subject in its own right. Studies in biography and in the experiments of these people will yield mature information on these points. The present social-economic concepts of such educational significance are based on the work of the sense realists. This philosophy, as developed with the growth of technology into a program of enrichment and integration as suggested by Bonser, Russell, Dewey, and Kilpatrick, opens a rich field for research.

There are many historical studies to be made about great schools. These are worthy of attention for the light which they can thrown on early policies, methods of teaching, and administration of shop work. The following are especially important: the Francke Institute at Halle in 1694; the Philanthropinum of Basedow in 1774; the various schools of Pestalozzi, especially the one at Yverdon about 1805; the Fellenberg Institution at Hofwyl in 1799; the school at New Harmony, Indiana, in 1825; the Manual Labor Schools of the early nineteenth century in the United States; the Van Renssalaer School of Engineering at Troy, New York, in 1824; the school at Naas in Sweden in 1875; the Oswego, N. Y., Normal School; the early schools for teacher education and industrial arts in America, such as the Stout Institute in Menomonie, Wis., in 1902; the Bradley Polytechnic at Peoria, Illinois, in 1903; School of Mechanic Arts of the Massachusetts Institute of Technology at Boston, in 1876; the Manual Training School of Washington University, St. Louis, Missouri, in 1879; the Chicago Manual Training School in 1884; and the Philadelphia Manual Training School in 1888.

Numerous studies are possible on great movements leading to industrial-arts education. They necessarily overlap studies concerning great schools and men. Yet they stand out as representative of a certain type of research. For example, the manual-labor movement of the early nineteenth century, the manual-training movement of the late nineteenth century, the Sloyd movement, the manual-arts era, the industrial-arts era, adult education, the present Youth movement, the Civilian Conservation Corps, and the Federal Emergency Relief Workers.

Studies in the financial support for practical education will be profitable in interpreting legislation, such as the Morill Act of 1862 and the Smith-Hughes Act of 1917. A careful interpretation of the latter in various states and territories might well make a major research or several minor ones.

The evolution of child-labor laws in England and America point to future problems concerning older children and adults. As this covers the long period from the beginning of the nineteenth century to the present, it might easily furnish several significant studies.

Some work is already under way concerning the lives of leaders in the industrial-arts movement. A study of the life and work of Frederick Gordon Bonser is now under way by Raymond Phipps of New Britain, Connecticut. Other possibilities for biographical researches are: John D. Runkle, C. M. Woodward, Booker T. Washington, Charles A. Bennett, Lorenzo Dow Harvey, Cygnaeus, Solomon, Larson, Kunou, and Richards. The responsibility which each of these men had for industrial-arts education will be interesting to trace. Each has unique contributions. Biographical studies concerning them should be valuable in building for the future, as well as for the sentimental values which the student will derive in becoming acquainted with them.

Nomenclature has been mentioned as an area for study in professional ancestry. Herbert Hutchinson has already done a notable piece of work in this direction. There may be room for other studies of an etymological nature.

The *Ohio Prospectus for Industrial Arts* has already been cited. Chapter five points to opportunities for studies in the material heritage. The studies have to do with origins and developments of form utilities: food, clothing, shelter, tools, machinery, and utensils, as classified by Bonser. Transportation and communication may be added to this list. The lives of great craftsmen, such as Della Robbia, terra-cotta modeler; Cellini, goldsmith; Chippendale, furniture designer; Stigel, the glassmaker; French, the engraver; Kirchmayer, wood carver; Saint, the stained-glass window designer; Yellin, ironworker; Baggs, ceramist; Jensen, the silversmith, and da Vinci, the artist,[3] will furnish many interesting studies covering a part of the great material heritage about which we need to know tremendously more if education is to be enriched according to our present democratic philosophy.

A number of new books are coming off the press concerning a great material heritage. Among these are the following: *Paper Making Through Eighteen Centuries* by Dard Hunter of Chillicothe, Ohio; *Techniques in Civilization* by Lewis Munford; *The Autobiography of Benvenuto Cellini; The Life of Leonardo da Vinci; Merchant Venturers in Bronze;* and *The Technical Arts and Sciences of the Ancients.*[4] Manufacturers of the various form utilities are doing considerable research themselves in the media from which their products are made. Many of them have set up research laboratories and museums representing the evolution of their products. Much printed information on the material cultures can be had for the asking. Studies which will locate and co-ordinate all of this information will be especially valuable in the enrichment of industrial-arts programs.

This exposition has attempted to show that in the area which we may classify as historical research there are tremendous possibilities for studies which may be invaluable in determining future industrial-arts programs, as well as policies in general education. These studies cover two large divisions; namely, *professional ancestry* and *material heritage*. The professional ancestry covers the evolution of the aims or objectives of education; the great schools in which it has developed; the great educational movements which have promoted it; the efforts at financial support; the great men back of the movements, and responsible for ideologies; and the development of nomenclature. Studies in material heritage go back as far in history as the remains and relics of manual effort can be traced. These studies will be concerned largely with those things developing in the countries bordering on the Mediterranean Sea and the Indian Ocean which hold the beginnings of civilization. The evolution of style in furniture, dress, and architecture may be studied through the material cultures of the different periods. Archeological discoveries in China, Central and South America are extending the areas of this study.

[3] See footnote 2.
[4] See footnote 2.

Theory and Practice

Donald M. Kidd

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An evaluation of the importance of skill and theory in the training of the worker.

There has long been discussion among educators regarding the relative importance or values of theory and practice. To clarify our thinking, we should understand the meaning of the terms used. Since practice means the acquisition of skill, the words, practice and skill, may be used interchangeably. We must also consider the means for obtaining practice, that is, the job.

The Job. The job, then, is the thing to be done, the task to be accomplished. Its function is to gain skill in the performance of operations and processes.

The Skill. The skill is the ability to perform operations and processes. Practice is fundamental to its acquisition. This means repetition. The number of repetitions, other things being equal, determines the amount of skill acquired. Skill involves practice until the act becomes habitual. It varies with the amount, intensity, and correctness of the practice.

The Theory. The theory is all the factors involved with the exception of the practice, things used for practice, and the skills acquired. Some educators say it is the "How and the Why" of the job. It is the science, the mathematics, the safety hygiene, the facts about the use of tools, equipment, materials, etc. It has the following purposes: The job is better understood. It aids in the performance of the same processes, operations or jobs in new or different situations.

Most every job, unless it be a routine operative job, is performed or done under conditions or situations which vary. These variations may be concerned with materials, tools, and equipment, atmospheric or climatic conditions, or the worker himself. Materials may vary in respect to hardness, softness, workability, and other characteristics. Tools vary in the amount and effect of wear, lack of lubrication, construction, and how they operate. Atmospheric conditions influence materials, tools, and the worker himself.

Consideration must be given to the fact that the amount of theory which may be taught varies with the subject. In advanced electricity, the laboratory work clarifies and adds to the understanding of the theory. This subject needs much more theory than others. The amount of theory which the students can use or absorb is determined by their I.Q. and also how it is taught.

What, then, is most important — the *job*, the *theory*, or the *skill?*

The Job. The job is the vehicle for the acquisition of skill. It is the means toward an end. After it has served its purpose, it then is relatively unimportant, excepting as it may serve as a keepsake or be used as a useful article.

The Skill. It becomes relatively unimportant after it is acquired. It is then habitual and is part of our accumulated experience. All that it needs is occasional practice. It may be the basis for the acquisition of additional skills. It becomes one of the many skills which we have acquired, such as ability to write, read, do problems in mathematics, lace a shoe, etc. It may differ from the skill of lacing the shoe, writing, etc., only in degree and function. While it is being acquired, it is of most importance.

The Theory. The president of the American Federation of Labor says union men have skill to sell. However, the theory allows us to use the skill on the job. Conditions usually vary with the job. The theory allows us to interpret the job so that it can be done under new conditions.

The skill of even the most expert workman is of little use if he cannot interpret the new conditions. Many men can do a very skillful job, but would do more satisfactory work if they understood the theory. This is the reason we have foremen in factories. Many of the men are more skilled than the foreman, but do not understand the theory. This is why graduates of technical high and other institutions of similar type obtain positions of leadership. This is why graduates of apprentice-training courses usually are more successful workmen than the journeymen who learned their trades by the old-type methods where theory was not stressed. Even the operative job becomes more satisfying and worth while if the workmen know the theory. This is also the reason why a person who does not know the theory must attack the new problem by the trial and error method. He must try various methods until he finds one which will work under the new conditions. This is wasteful of time and effort.

Very often time could be saved if men knew the theory. They would recognize a better way of performing the operations and processes. A man working on a lathe found that the chips were curling around the work and had to be taken off after each cut. Another man who knew the theory of the job, suggested that he regrind the tool at another angle. This solved the problem.

Some teachers hold the following point of view: "The facts and laws of the theory of the job probably do not have a very great effect upon a pupil's ability to learn to do a particular job in the shop. To know about the kinds of trees from which lumber is made cannot make a better craftsman of a carpenter; to understand the laws of capillarity, and the oxidation of linseed oil, cannot increase the skill of the painter in handling

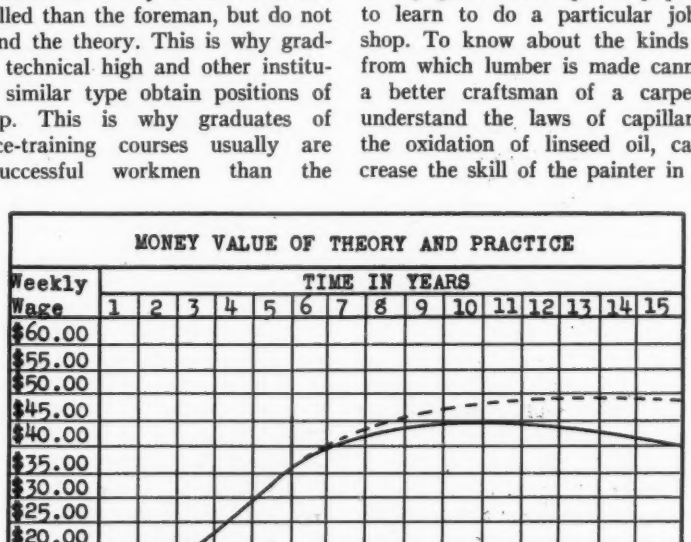


Table I. Money value of theory and practice

a brush; a knowledge of the molecular constitution of matter cannot make a better blacksmith; in fact, there is very little evidence to indicate that so far as the skill of a trade is concerned, an industrial worker needs a knowledge of the theory. Long before theory had won its modern recognition there were skilled workers in all the branches of industry.

There is no doubt but that this is an extreme view. The carpenter who understands lumber can pick out the kind of wood best suited for the particular job much more quickly than the untrained man. This means that although the carpenter cannot saw a board more accurately or quickly because of this knowledge, he can, on the other hand, save time and material because of his knowledge of what might be termed the theoretical aspects of the trade. This is the man whom we may consider the skilled mechanic. The painter may use a brush to the limit of his capacity, but if he understands fundamental facts regarding the oils and other ingredients of the materials which he used, he is able to apply finishes which are best adapted to the job.

Table I indicates the monetary value of a knowledge of the theory of the job. It is taken for granted that both workers have the necessary skill.

To sum up then, we may say that the job, the skill, and the theory are relatively most important at various stages of the learning process. That eventually the theory is most important because it allows one to carry on to a higher degree of attainment. Measured in terms of satisfactions and economic returns, it is eventually most important.

The psychology of learning indicates that we learn better and more quickly if the theory is tied up with the practical problems. More connections and associations are made, therefore, the student would remember better and at the same time the subject matter would be more meaningful. The recall of the demonstration is better if tied up with the theory. This is economy in education.

Guidance—The Shop Teacher's Responsibility

Claude F. Turner

James Monroe Junior High School, Seattle, Washington

Striving to discover and satisfy the needs of the pupil is the aim of the real teacher.

"Whoso teaches a child labors with God in His workshop." To this inscription over the entrance of College of Education High School at Greeley, Colo., might well be added, that he who inspires a boy so that he glimpses his own possibilities for some honorable service in life, is a master craftsman.

Self-initiative, self-control, social consciousness, honesty, and courage have always been needed and always will be needed in human society. We must admit that it is the avowed purpose of our educational systems to mold the child's habits of mind and to arouse in him only the noblest and finest impulses. How are we to bring this about? Too few of us have any real understanding of the mental development and possibilities of the individual child. Until recently there has been little study of the needs of the individual student and little contact with the student as an individual. We have been operating on the mass production basis of industry.

On the secondary-school level, many systems are attempting to remedy this lack of understanding by more or less comprehensive guidance programs. Since industrial arts have become an integral part of the general educational experience of practically all pupils, it may be well to point out some specific places wherein the industrial-arts teacher may become a functioning part of such a program.

In facing the guidance problem we must first of all realize that modern life is becoming increasingly complex. We are all bound up in a struggle to supply our wants and in ordering our actions and our thinking so that they will bring us the greatest return in real happiness. This struggle is especially marked in youth, which ofttimes sees only a blank wall ahead. The school is vitally interested and concerned with the three choices that youth has to make; the choosing of a life ideal, the choosing of a life vocation, and the choosing of a life mate. The serious difficulty today seems to lie in a lack of balance between what youth knows and the spiritual and moral significance of that knowledge. The guiding purpose should be to help youth secure a proper, balanced perspective.

Guidance, although it appears new today, is as old as time. The present emphasis upon the development of the whole child has furnished added force and renewed vigor to the movement. Guidance cannot be construed as something you do to a child, but rather as a process whereby you build up in him the desire and the power to do something for himself. In the larger sense, guidance should take place throughout the entire school day of the student. It involves the sympathetic understanding of pupil's interests, aptitudes, and abilities, together with a conscious effort to help each pupil make the most of them. It means that the teacher must be encouraged to play a large part in the guidance program of the individual school if such a program is to bear fruit. He should be able to sense the symptoms of maladjustment in the pupil in the incipient stages, contribute to the diagnosis of the causes of such maladjustment and assist in the application of the corrective or remedial measures advised. This of course would mean that every teacher must be alert to the immediate problems of the child. To the industrial-arts teacher it means that each child must become more of an individual and less of a bench number. Furthermore, the teacher may give specific guidance to pupils in the pursuit of intellectual interests, in the development of proper conception of the processes of education and the opportunities for education provided by his immediate school system and the state.

This phase of the modern educational program should arouse the interest of the wide-awake industrial-arts teacher because it places his department in its true relation to the whole school program for perhaps the first time.

Research in books and magazines, class discussion, and experiments are a vital part of the industrial-arts program developing related technical and occupational information as well as contact with preliminary vocational training. This fact is realized by most industrial-arts teachers, but what they do not always fully comprehend is the fact that these same objectives are part and parcel of any comprehensive guidance program. Teachers in the industrial-arts branches are fortunately situated to give the friendly, helpful, personal interest and advice that is so necessary to the development of the adolescent. They are granted an opportunity to see the boy as

he actually is, not hemmed around by the inhibitions exhibited in the academic classroom. This personal touch plays an important role in the development of a good, responsible citizen. Youth craves someone in whom to confide. Often an informal conversation between pupil and teacher leads to tangible results in that the pupil becomes conscious of his capacities in relation to some satisfying and honorable service as a life work.

If there is any one thing that the student in secondary school needs, more than anything else, it is information which will enable him to find a suitable vocation. It is difficult to find reliable material of this nature. Books written one year become unreliable sources of information the next. There is need for separating the wheat from the chaff. In order to choose wisely today, a young person must understand the present and anticipate the future. The increase of machinery and new inventions are changing the future of jobs every day. The fact that most pupils in secondary school do not know what they want to be is not a reason for great concern in view of modern industrial and occupational trends. It is vitally important, however, that pupils be guided by facts rather than by hopes in making their plans for the future. Here again the shop man is in a position to render a worthwhile guidance service by giving these young people an adequate understanding of occupational trends, the qualifications needed for and the nature of work in his particular field and in related fields.

Guidance for leisure is another point where the industrial-arts teacher can exert a strong influence on the adolescent. Particularly appealing is the idea of constructing workbench and tool sets for home use through intershop correlation. Many a boy has equipped a creditable home workshop that stands as a monument to the inspiration furnished by some shop teacher. Other guidance projects in model boat building and racing, in leathercraft, art metal work, and wood carving make a strong appeal. These projects have the additional advantage of being low cost activities and well within the reach of the finances of the average boy. Many teachers are doing excellent work along this line. It is imperative that more should be done if the industrial-arts department of the school is to keep pace with modern educational demands.

Important as the finished projects of the shop are, the day has passed when the industrial-arts teacher can judge his success by such yardsticks. He must also give consideration to what these finished projects have done to the students who constructed them. What attitudes toward work and their fellows have they developed? How many of them have set for themselves higher goals of responsibility and personal development? He must ask himself if he is sincerely interested in developing to the highest possible degree the human material in his charge or if his chief interest is in shop routine, tools and supplies? In the answer to his question lies the difference between a custodian of tools, masquerading as an industrial-arts teacher, and a master craftsman.

Progress Chart for the Millroom

R. A. Hicks

Technical High School,
San Jose, California

An outline and a progress chart that may be helpful in woodworking classes, and suggestive for other shops.

Upon entering the mill cabinet class in the San Jose Technical High School, the student is taught to realize that he is entering upon a new era in his education. He is definitely upon his own. He soon learns that he has no one to rely upon but himself. Trade conditions predominate as near as can be set up in a school shop. Trade terms are used and the student is encouraged to use these terms whenever speaking of anything relative to his chosen trade.

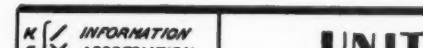
The course of study of this shop is built around actual trade operations, set up by the instructor and criticized by an advisory committee composed of millmen from the mills in the vicinity of the school.

The course covered is set up under learning difficulties rather than type jobs and these learning difficulties are broken up into a series of jobs under the heads of different units set out in the form of a large chart which each student has access to, so he can readily see just how he is progressing.

There are three checking levels: information, appreciation, and completion. When a student receives information on a job, the mark shown in Figure 1 is made in the square under the job and opposite his name. When he can do this particular job quite well, a line is drawn in the opposite direction across the one already earned, thus forming an X as shown in Figure 2. When the student has acquired the skill to do the job in a manner accepted as satisfactory by industry, a circle is drawn around the X as shown in Figure 3. In this way both student and teacher know that a particular piece of instructional work has been accomplished.

All of the manipulative instruction in the shop is individual, and the course of study is flexible enough to allow a student to begin anywhere and progress as rapidly as his ability permits.

This chart has been valuable in many ways. When the question of placement arrives, the instructor has something concrete on which to base his statements to the



KEY: / INFORMATION, X APPRECIATION, ⊗ COMPLETION	UNIT A — SANDER JOBS										UNIT B — GRINDER JOBS					
NAMES	OILING MACHINE	SANDING FLAT SURFACE	DISK SANDING	SPINDLE SANDING	SANDING CURVED SURFACE	SIZING ON DISK SANDER	FASTENING BELTS	OPERATE MACHINE	PUT PAPER ON DISK	OILING MACHINE	USE A WRENCH	GRIND A SINGLE BEVEL TOP	GRIND A GOUGE	SHARPEN A CUTTER	DRESSING GRINDING WHEEL	REPLACING
ANDERSON, A.	X	/	⊗	⊗	/	X	⊗	X	X	X	/	X	X	X	X	⊗
BROWN, F.	⊗	X	X	X	⊗	⊗	⊗	⊗	⊗	X	X	⊗	X	X	X	X
COLE, W.	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	X	/	X	/	/	X	X
DEWEY, R.	/	X	X	/	/	/	X	⊗	⊗	/	/	X	/	/	/	X
EDWARDS, R.	X	X	⊗	⊗	⊗	⊗	ETC.									

Fig. 4. Progress chart for the millroom

TABLE I. Analysis of Jobs. Student Checking Chart — Mill Cabinet Shop

Unit A. Sander Jobs
1. Oiling machine.
2. Sanding flat surfaces.
3. Disk sanding.
4. Spindle sanding.
5. Sizing on disk sander.
6. Fastening belts together.
7. Operating machines correctly.
8. Putting sandpaper on disk.

Unit B. Grinder Jobs
1. Oiling machine.
2. Using wrench.
3. Grinding single beveled-edge tools.
4. Grinding a gouge.
5. Shaping a cutter.
6. Dressing a grinding wheel.
7. Replacing a grinding wheel.

Unit C. Swing-Saw Jobs
1. Read a rule.
2. Use a wrench.
3. Oiling machine.
4. Changing saws.
5. Lacing a belt.
6. Jointing a cutoff saw.
7. Filing a cutoff saw.
8. Cutting stock to rough length.
9. Cutting duplicate pieces.
10. Judge if bearings are O.K.
11. Balancing machine.
12. Operate machine correctly.

Unit D. Jointer Jobs
1. Read a rule.
2. Use a wrench.
3. Oiling machine.
4. Lace a belt.
5. Joint stock on edge.
6. Sizing stock.
7. Facing material.
8. Beveling stock.
9. Making a glue joint.
10. Jointing end wood.
11. Taking out knives.
12. Sharpening knives.
13. Balancing knives.
14. Replacing knives.
15. Babbiting.
16. Operate machine correctly.

Unit E. Universal-Saw Jobs
1. Oiling machine.
2. Read a rule.
3. Use a wrench.
4. Adjust fence.
5. Ripping stock to widths.
6. Dadoing.
7. Grooving.
8. Cutting stock to length.
9. Mitering.
10. Operate machine correctly.

Unit F. Plane Jobs
1. Oiling machine.
2. Read a rule.
3. Grinding stock when feeding.
4. Use a wrench.
5. Planing stock to finished thickness.
6. Operate machine correctly.
7. Adjust pressure bar.
8. Jointing knives.
9. Grinding knives.
10. Setting knives.

Unit G. Band-Saw Jobs
1. Oiling machine.
2. Read a rule.
3. Use a wrench.
4. Coil band saw.
5. Put saw on machine.
6. Adjust guides.
7. Saw to a straight line.
8. Saw to a curved line.
9. Resaw material.
10. Test bearings for wear.
11. Check wheels for alignment.
12. Dress a braze.
13. File a band saw (by machine).
14. Braze a band saw.
15. Operate machine correctly.

Unit H. Mortiser Jobs
1. Read a rule.
2. Use a wrench.
3. Set up machine.
4. Prove machine.
5. Adjust machine.
6. Change chisel and bits.
7. Mortise to a given depth and face.
8. Mortise through a piece.
9. Sharpen chisel.
10. Operate machine correctly.

Unit I. Tenoner Jobs
1. Read a rule.
2. Use a wrench.
3. Tenon across a piece.
4. Set up machine for face.
5. Adjust trim saw.
6. Dado across the grain.
7. Fit tenon to mortiser.
8. Set machine for duplicate pieces.
9. File trim saw.
10. Adjust for offset tenoning.
11. Operate machine correctly.

Unit J. Turning Lathe Jobs
1. Read a rule.
2. Lace a belt.
3. Use a screw driver.
4. Sharpening chisel.
5. Set up piece between center.
6. Duplicate turning.
7. Turning to size.
8. Turning a piece on face plate by scraping.
9. Set up a piece on a face plate.
10. Turn piece between center by cutting.

Unit K. Boring Jobs
1. Put bit in machine.
2. Adjust machine for different thickness.
3. Bore to right and left.
4. Bore to a layout line.
5. Bore to a given depth.
6. Sharpen bit.

Unit L. Assemble Jobs
1. Read a rule.
2. Drive a nail.
3. Scrape off glue.
4. Drive a dowel.
5. Read a drawing.
6. Set up sections.
7. Glue sections together.
8. Pair up duplicate parts.
9. Put on clamps.
10. Square up work.
11. Prepare glue.
12. Put on hand screws.

Unit M. Laying Out Jobs
1. Read a rule.
2. Read a drawing.
3. Understand the scale.
4. List from drawing.
5. Lay out a rod.
6. Face up duplicate parts.
7. Pair up parts.
8. Layout for machines.
9. Layout from rod.

Unit N. Tool Jobs
1. Use a countersink.
2. Know how bits are marked.
3. Set a nail.
4. Bore a hole for a screw.
5. Use a gauge.
6. Use a screw driver.
7. Use a crosscut saw.
8. Use a ripsaw.
9. Use a back saw.
10. Set up and care for a block plane.
11. Set up and care for a jack plane.
12. Set up and care for a jointer plane.
13. Set up and care for a smooth plane.
14. Bore a straight hole.
15. Use a spokeshave.
16. Use a draw knife.
17. Use a router plane.
18. Use a chisel.
19. Use a gauge.
20. Sharpen chisel.
21. Sharpen an outside gouge.
22. Sharpen a scraper.
23. Use a scraper.
24. Use a rabbet plane.
25. Set up and care for a rabbet plane.

Unit O. Joint Jobs
1. How to make a butt joint.
2. How to figure and make a miter joint.
3. Know how to make a mortise and tenon joint.
4. Know how to make a dovetail joint.
5. Know how to make an offset tenon joint.
6. Know draw construction.
7. Know table construction.
8. Shop sketching.
9. Drawing enough for job in hand.
10. Elements of full size detailing.
11. Know how to prepare animal glue.
12. Know how to apply animal glue.

Unit P. Shaper Jobs
1. Oiling machine.
2. Read a rule.
3. Grind pair of simple cutters.
4. Shape against collar.
5. Shape circular stock.
6. Shape against pattern.
7. Shape under cut.
8. Shape over cut.
9. Square shape.
10. Groove.
11. Change depth of cut.
12. Form shape.
13. Set up machine for type jobs.
14. Balancing cutters.
15. Temper a pair of simple cutters.

prospective employer; the student watches his own progress and it is a check on the instructor to see that he is covering everything that the student is supposed to get.

Figure 4 shows a section of the progress chart used in the mill cabinet class, and Table I shows a complete list of jobs under each unit on the chart.

The question may arise, "Why not mark the boys in percentages?" The state law does call for this, but the employer is not interested in figures. His question is, "Can he do the job?" He does not care if the student is 80 or 60 per cent perfect. His one question is, "Can he produce?"

In addition to the manipulative work covered, the student writes a series of papers which are due on a prescribed day of each week on some scientific subject relative to the millwork trade such as, "Seasoning of Lumber," "Manufacture of Glue," etc. These subjects are usually found by the student after searching through books, trade journals, and sometimes newspapers. The reason for this is to give training in how to obtain information on any new subject, an achievement of vital importance to the apprentice boy.

Mathematics is checked very much in the same way up to the application of it on the job itself, but fundamentals are taught in a class and checked individually.

The writer has found the chart method of checking the progress of a group of students very efficient, not alone in manipulative work but in trade related work as well.

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION
J. J. Metz, Editor

Modern Design

The August, 1937, issue of the *Commentator* carries the following comment on what is commonly termed "modern design":

"A great deal of *modern* decoration and furniture looks as if it had been conceived so that it could be given frequent hosings with carbolic acid. This is all right in a hospital or a factory or perhaps an office, but it hardly establishes the right environment for a home. It is much too trim and angular and austere. A tree or a Boston rocker or an old-fashioned coverlet comes nearer to harmonizing with gnarly, homely, honest, ought-to-be-humble human nature as we think of it.

"Another quarrel we have with *modern* designers is that, while they profess to be daringly original, no artists of any time have been such copycats and apes. See one room of modern design and you have practically seen them all. This, in the work of artists who make great pretensions of defying traditions!"

The writer of this comment indicates his disapproval of modern furniture design quite emphatically. No doubt, he is taking quite an extreme view and many of our readers will not agree with him at all.

His criticism, however, does present an aspect of the problem which deserves attention. There are always those who are not satisfied with that which is at hand. They are looking for the new and the different. They inaugurate change, sometimes for the better, sometimes for the worse. Usually these individuals are very positive. They are likely to overestimate both the disadvantages of that which they wish to discard and the advantages of that which they wish to introduce. Naturally, these positivists acquire quite a following who in turn imbibe more or less of the enthusiasm and fervor of the leaders. In this way, partisan groups come into existence who not infrequently place an importance on that which they hold true, which is way beyond the value of that which they actually produce. After these leaders have determined their point of departure from the customary, they usually provide themselves with shibboleths and well-sounding terms and phrases to defend their innovations.

In the field of furniture design, we now have the terms modern, modernistic, and contemporary, all of which are to indicate the last-minuteness of a given design. As a matter of fact, each age has gone through these throes of change. In the *Encyclopedia Brittanica,* under "Egypt," one reads: "In the reign of Amenhotep III, a new impulse towards freedom in art was given. . . ." Even at that distant age there were modernists and adherents of contemporary design, men who were not satisfied with that which their predecessors had done. Not all of the changes produced by Amenhotep's designers were really improvements, nevertheless, they were experimentations which added to the sum total of human knowledge, and as such they were worth while at that age and have been worth while throughout the ages that followed.

In all discussions about art and design, it is well to remember that not all of the old is bad nor all of the new is good. There are many who delight in self-expression who will never be able to function as original designers. For such it is better to copy a good design, be it from an old or a new master, so long as the copy represents an earnest endeavor to follow where the master intended to lead. It is well also to remember that a design gains nothing from merely being modern or contemporary, nor that an old design must be copied so slavishly that a desirable change may not be made.

At present the term "functionalism" is greatly overworked in connection with design. As a matter of fact, function should form, and to a considerable extent always has formed the basis of design. The savage who built the first raft was confronted with a need and, taking the materials at hand, he tried to create something which would function in supplying this need.

When function alone is considered, designs are likely to be crude, stiff, and uninteresting. However, when proportion, balance, appropriate ornamentation, wise selection of material, and proper construction are all harmoniously combined, the article designed will not only function but be pleasing as well.

An article thus produced would still have to be placed in an environment in which it would fit. A fine piece of period furniture might look quite out of place in a room built and decorated according to strictly modernistic concepts, just as the angular lines of a piece of the better type of contemporary furniture might look entirely out of place in an old English home.

There seems, then, to be little need for the extreme partisanship shown in speech and writing for either the old or the extremely new. Wise and careful discrimination will help the designer avoid the objectionable and bring out the good that both contain. Common sense will prevent him from ascribing to lines emotional and esthetic qualities in the one, while denying them in the other. Above all, it will help him to overcome the common fault of looking upon the new and different as something to be revered and to scoff at everything that the past has produced.

Each age has left its mark upon the sands of time. Our age will do the same, as will also future ages. Each individual, then, should do what is within his power without vain-gloriously praising the products of his own hands at the expense of those produced by others. It is well to remember that if we concede to every man the right to his own opinion in everyday matters, the individual artisan may rightfully claim the same right in his decisions on the design which he wants to produce.

Guglielmo Marconi

On Tuesday, July 20, 1937, the world was startled by the radio announcement that Marconi, the father of radio, had succumbed to a heart attack at Rome. The very instrument of communication which he had spent the greater part of his life in devising and perfecting was the means used to notify the peoples of the earth that they had sustained a tremendous loss.

Guglielmo Marconi was born at Bologna, Italy, on the 25th of April, 1874. He received his education at Bologna, Florence, Leghorn, and at the University of Bologna. Throughout his years at school, he took great interest in the physical and electrical sciences. He became especially engrossed in the

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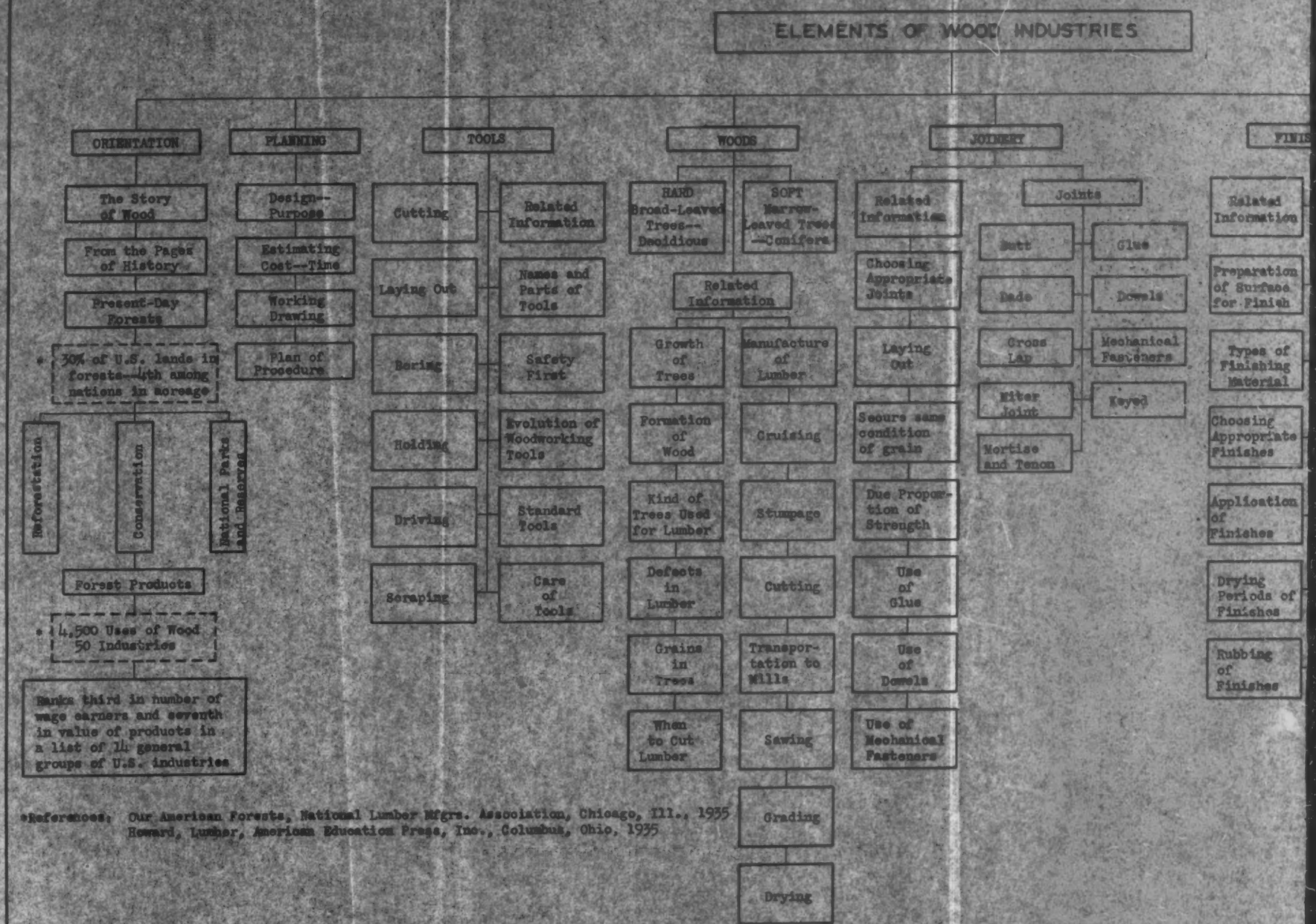
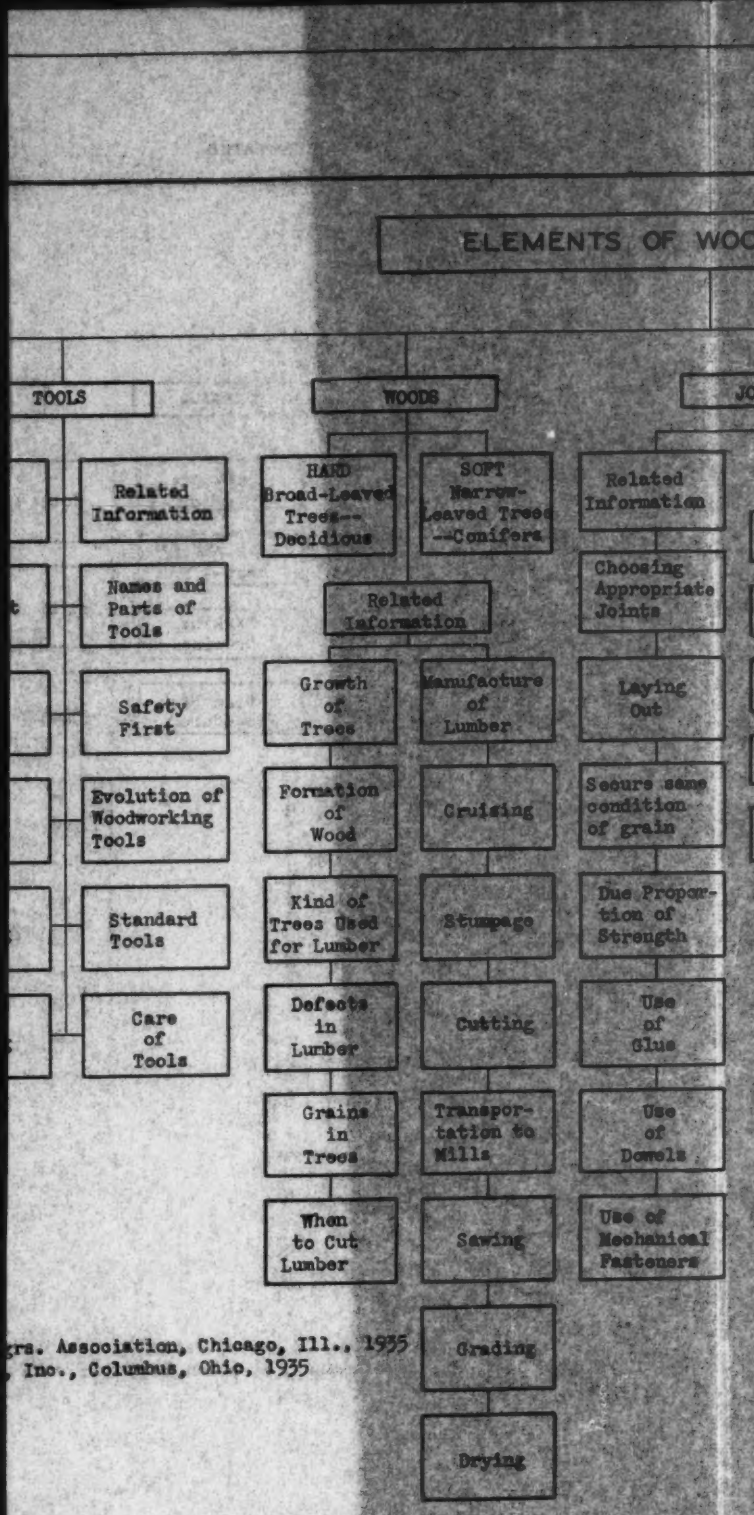


*References: Our American Forests, National Lumber Mfgrs. Association, Chicago, Ill., 1935
Howard, Lumber, American Education Press, Inc., Columbus, Ohio, 1935

Submitted by: George C. Decker, State Teachers College, Buffalo, New York



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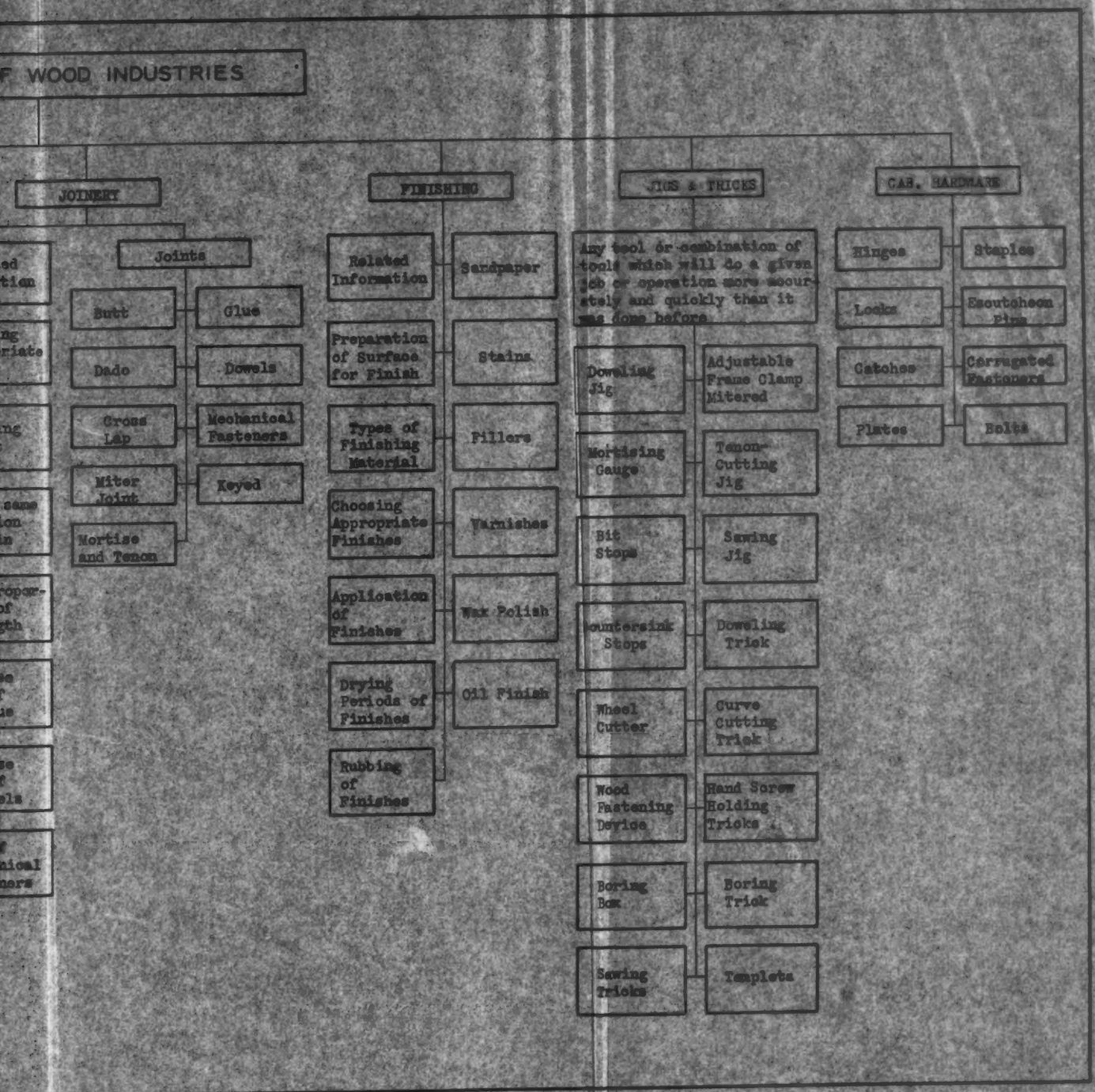

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electrical manifestations whose existence Thomas A. Edison had discovered as early as 1870 and which were later identified by and named after the German scientist, Heinrich Rudolph Hertz.

Marconi learned to reproduce these Hertzian waves at the University of Bologna, and he got the idea that they might be utilized for the transmission of signals as a means of communication. One story has it that he got this idea while sending heliographic messages in the Italian army. Messages of this kind, of course, could not be transmitted on cloudy days, so he made a crude electrical device which enabled him to send a telegraphic message for a distance of a mile. He continued to work on his invention and was able to improve it so that messages could be sent over longer distances.

He was not able, however, to interest the Italian government in his efforts to perfect wireless telegraphy, hence he went to England where the English Post Office Department, seeing the value of the new method of communication, assisted him in carrying on further experimentation. On March 27, 1899, he succeeded in sending a message from Bologna, France, across the English Channel to South Foreland, England, a distance of 32 miles. As his system of communication became more and more successful, the Italian government began to realize its real value. Marconi was accordingly invited to return to Italy and he established a station for communication with Italian warships at Spezia. In 1899, he visited America, and his system of communication was used here in reporting the presidential election in 1900. In the meantime, he kept on working steadily with the idea of ultimately sending a message across the ocean, and on December 12, 1901, at 12:30 p.m., he could proudly proclaim to the world that he had accomplished this feat. He was 27 years of age at this time.

Advances after this were rapid, and by December, 1902, regular communication service between Canada and England had been established. By 1904, intercommunication between ships at sea and the coast on either side of the Atlantic Ocean was an established fact. Other experiments followed and in 1906 he was ready to demonstrate his new persistent-wave system. In 1910, he produced an improved detector and a new receiver and a little later perfected a method which permitted messages to be sent and received simultaneously over the same instruments. On May 30, 1925, he succeeded in projecting the human voice from England to Australia. During the last years of his life, he spent considerable time experimenting with electrical waves of exceedingly short length.

Like all great inventors, Marconi had to suffer much from the envy of other scientists and engineers who tried their best to minimize his accomplishments. In spite of this, however, he went on doing what others thought impossible and left the world the better for his efforts.

As his fame became better established, both his native land and other countries began to shower honors upon him. In 1909, the Nobel prize for physics was conferred on him. He was also decorated with the Albert Medal of the Royal Society of Arts, the Franklin Medal, and the John Fritz Medal. Italy made him a senator for life. The Universities of Glasgow, Oxford, Aberdeen, Columbia, Pennsylvania, Louisiana, and the City College of New York, conferred honorary degrees upon him. England, Russia, and Spain decorated him, and Italy conferred upon him the Grand Cross of the crown of Italy. During the world war he was commissioned as an officer in both the army and the navy of Italy. His country also sent him as a delegate to the peace conference at Paris. In 1929, he was raised to the Italian nobility with the title Marchese Guglielmo Marconi. At his death, he was president of the Italian Royal Academy and of the National Council of Research.

In spite of his success and the acclaim generally accorded him, he remained unaffected and modest. Among the things which he cherished most was Edison's answer, "If Marconi says it is true, it is true," given to a skeptic who refused to believe the report that Marconi had succeeded in sending a message across the ocean. Another highly prized possession was the gold medal presented by the survivors of the Titanic disaster who wanted to show their gratitude to him for inventing the device which sent the SOS to which they owed their lives.

Marconi's death was sudden and unexpected. On Saturday, three days before his end, he conferred with the Pope about the new radio station being built for the Vatican. He died on Tuesday, July 20, 1937, at the age of 63. His body lay in state at the Royal Academy at Rome until Wednesday, when it was transferred to the church of St. Mary of the Angels, where the funeral services were held. These were attended by Premier Mussolini, many church and state dignitaries, and a large number of people. The body remained in this church until it was removed for interment, which took place on Friday, July 23, at Bologna.

Marconi's life demonstrated the need of the type of education for which the industrial-arts and vocational-education teacher stands. It was Marconi's understanding of science, plus the ability of making practical applications of his knowledge, which resulted in the invention and perfection of the radio. His accomplishments demonstrate how necessary and valuable it is in our present mechanical age that education provide this intimate union of the technical and the practical.

Convention Speeches

In a comparatively few months, the convention speaker will again be with us. Teachers as a rule must attend more conventions and listen to more speeches than fall to the lot of the ordinary man. It may be timely, therefore, again to call attention to the fact that convention speeches should be couched in language that is understood by the average listener. The *New York Sun* has again and again protested the use of stilted language in speeches of any kind. As an example of what not to do, the following, taken from a speech delivered at a sociological conference that had been held at Pittsburgh, may be quoted: "Crime or delinquent manifestations are understood as symptomatic expressions of an action tendency that extends throughout the behavior structure of the community."

Sad to say, teachers, too, have to listen to jargon of this kind when the same thing could have been clothed in good, but simple language. The rank and file of shop teachers will undoubtedly thank all speakers who are moderate in the use of pretentious words. Great thinkers usually express themselves in straightforward language. They do not need to cover poverty of ideas with flowery language. It were well if convention speakers generally followed their example.

Teaching Aids

Wayne P. Hughes

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The following list of references to sources of helpful and suggestive material that may be obtained free or for a nominal sum will be found valuable especially by instructors of woodworking and woodfinishing.

Aluminum Company of America, Pittsburgh, Pa., "Aluminum Paint: Its Uses and Applications"; "Aluminum Paint Specifications."

American Lumberman, 431 S. Dearborn St., Chicago, Ill., "Touch Wood" (15c each — 10c in lots of ten).

American Reedcraft Corp., 130 Beekman St., New York City, "Cane Seat Weaving"; "Colonial Chair Frames"; "Creative Handicraft" (free).

American Screw Company, Providence, R. I., "Wood Screw Charts," indicating relative recommended pilot-hole sizes; circulars describing Phillips Recessed Head Screws and Tools (free).

American Tree Association, 1214 Sixteenth St., N. W., Washington, D. C., "Constitution of the United States with Tree Planting Instructions"; "The Forestry Primer"; "The Forestry News Digest."

American Vocational Association, Inc., 1115 Denrike Bldg., 1010 Vermont Ave., Washington, D. C., "Standards of Attainment in Industrial Arts" (25c).

American Walnut Manufacturers Association, 616 S. Michigan Blvd., Chicago, Ill., "American Walnut for Interior Woodwork and Paneling"; "Walnut in the Art of Gracious Living"; "How to Identify Real American Walnut Furniture"; "Story of American Walnut" (free).

Appalachian Hardwood Manufacturers, Inc., 414 Walnut St., Cincinnati, Ohio, "Appalachian Hardwoods"; "Chestnut as a Core Wood"; "Appalachian Chestnut for Distinctive Interiors"; "Appalachian Beech, Birch, and Maple"; "Folger Shakespeare Library Architectural Woodwork of Appalachian White Oak" (free).

Art Inlayers, 2695—21st Avenue, San Francisco, Calif., "Catalog and 12 Veneer Samples" (25c coin); "Simplified Inlaying of Pictures, Novelties, etc."; "Veneering Requiring Little Equipment."

Atkins and Company, E. C., 402 S. Illinois St., Indianapolis, Ind., "How-To-Do-It Book" (10c); "Saw Sense" (free); "Crosscut Saws" (free); Demonstration Saw loaned for eight weeks (request on school stationery), or sold outright at cost of $3.60.

Atlas Press Company, 1819 N. Pitcher St., Kalamazoo, Mich., "Manual of Lathe Operation" ($1).

Behr-Manning Co., Troy, New York, "Abrasive Papers and Cloths" (free); "How to Sharpen" (free).

Berry Brothers, 211 Leib Street, Detroit, Mich., "Making Home Homelike"; "Natural Woods and How to Finish Them" (free).

Brodhead-Garrett Co., Cleveland, Ohio, "Industrial-Arts Supplies" (free).

Calcraft Corporation, 2732 Colorado Blvd., Los Angeles, Calif., "Catalog of Boat Parts and Motors."

California Redwood Association, 405 Montgomery St., San Francisco, Calif., "Redwood Information Series"; "California Redwood."

Carborundum Company, Niagara Falls, N. Y., "How to Sharpen Woodworking Tools" and small pocket stone in leather case (20c); "Romance of Carborundum" (free).

Casein Company of America, Inc., 350 Madison Ave., New York City, "Casco Glue Folder" (free); "Casco Gluing Guide" (free); "Projects Folder" (free).

Celotex Corporation, 919 N. Michigan Ave., Chicago, Ill., "Interiors That Speak of Charm and Comfort" (free).

Century Furniture Co., Grand Rapids, Mich., "Furniture" ($1.10).

Chicago Tribune, Tribune Tower, Chicago, Ill., "Refinishing Furniture" (5c by mail — 3c if called for).

Chicago Wheel & Manufacturing Co., 1101 W. Monroe St., Chicago, Ill., "Pleasure and Profit With the Handee" (free).

Clamp Nail Company, 422 N. Ashland Ave., Chicago, Ill., "Bulletin on Clamp Nails" (free).

Constantine and Son, Inc., Albert, 797 East 135th St., New York City, "Fine Cabinet Woods and Their Uses" (free — on school stationery).

Craftsman Wood Service Co., 2727 Mary St., Chicago, Ill., "Everything for the Home Craftsman" (free).

Cyco Mfg. Co., Davenport, Iowa, "Home Kraft Furniture."

Delta Manufacturing Company, 600 E. Vienna Avenue, Milwaukee, Wis., "Getting the Most Out of Your Drill Press" (25c); "Getting the Most Out of Your Band Saw" (25c); "Getting the Most Out of Your Lathe" (25c); "Getting the Most Out of You Circular Saw" (25c); "Getting the Most Out of Your Shaper" (25c); "Practical Delta Projects," Books 1, 2, and 3 (10c each); "Making Money With Delta Tools" (10c); "The Deltagram" (issued monthly, October to March inclusive, 50c per year); "Human Side of Delta Tools" (free); "What Others Have Done With Delta Tools" (free); Catalog (free).

Department of Commerce, Bureau of the Census. Washington, D. C., "Census of Manufactures, 1933, 1935."

Department of Commerce, Bureau of Standards, Washington, D. C., "Outside House Painting"; "Paints, Varnishes, and Related Products."

Department of Conservation, Springfield, Ill., "Forest Trees of Illinois" (free).

Detroit News, Handicraft Editor, Detroit, Mich., "Handicraft Plans" (small nominal charge).

Dewey, John, "The Manufacturer's Association and the Public Schools," *Journal of N.E.A.* 17:61–2, F. '28.

Disston & Sons, Inc., Henry, Philadelphia, Pa., "Disston Pruning Guide" (free); "Disston Saw, Tool and File Manual" (free); "Wall Charts on Hand Saws, Files and Hack-Saw Blades" (free).

Egyptian Lacquer Manufacturing Co., Rockefeller Center, 1270 Sixth Ave., New York City, "Egyptian Furniture Lacquers" (free); "Egyptian Lacquers for Machine Tools" (free); "The Art of Lacquering"; (free); "Egyptian Black Lacquers" (free).

Express Body Corporation, Crystal Lake, Ill., "Garden Craft Circular" (free).

Flexible Steel Lacing Co., 4607 Lexington Street, Chicago, Ill., "Short Cuts to Power Transmission" (free).

Grammes & Sons, Inc., L. F., Allentown, Pa., "Reference Book of Valuable Information on Safety Devices."

Grand Rapids Fibre Cord Co., Grand Rapids, Mich., "It Is Easy to Weave Art-Fibre"; "Art Fibre Furniture Weaving."

Grand Rapids Varnish Corporation, Grand Rapids, Mich., "Manual on Wood Finishing" (free).

Grand Rapids Wood Finishing Co., Grand Rapids, Mich., "Better Wood Finishing" (free).

Hamilton, E. T., "Coping Saw Carpentry"; "57 Articles Every One Can Make" (10c at Woolworth and other chain stores).

Higgins & Co., Inc., Chas. M., 271 Ninth St., Brooklyn, N. Y., "Romance of Industry" (free).

Home Craftsman Magazine, 115 Worth St., New York City, "One-Evening Projects" (50c).

Hooker Glass and Paint Co., 651 Washington Blvd., Chicago, Ill., "Catalog of Supplies" (free).

Iowa State College, Ames, Iowa, "Objectives of Industrial Arts Education": Statements of 138 leaders in industrial-arts education, 75 pages (75c); "Test Questions in Industrial-Arts Education": Objective test questions and answers for mechanical drawing, woodwork, metalwork, electricity, and printing, 100 pages (75c); "Poems for Teachers of Industrial-Arts Education": More than 200 poems which will appeal to craftsmen and teachers, 102 pages (75c); "Instruction Sheets in Industrial-Arts Education": Examples of good information sheets, assignment sheets, and operation sheets, 103 pages (75c); "Index to 2,500 Books on Industrial-Arts Education and Vocational Industrial Education": The most complete list of books yet published pertaining to the fields mentioned, 107 pages (75c); "Saws, Proverbs, and Maxims": Approximately 275 sayings which are suitable for posters in the industrial-arts laboratory, 11 pages (15c); "Buyer's Guide": A directory containing several hundred names and addresses of firms which specialize in supplying the several materials and supplies used by industrial-arts teachers, 35 pages (34c);

"Keene's Cement Craft": A manual describing the various ways of working Keene's cement, 49 pages (50c); "Leisure Time Bibliography": Of especial value to the person who assists in the home-workshop movement, 89 pages (75c); "A Guide to Woodworking Problems": A handy index to more than 400 problems in woodwork found in magazines and books most used by industrial-arts teachers, 30 pages (35c); "A Guide to Metalworking Problems": Several hundred problems are classified and indexed, 28 pages (30c); "Fifty Full-Scale Drawings of Wood-Turning Problems," 25 pages (35c); "Industrial-Arts Education in 1960": One-hundred-five predictions as to changes in emphasis, 12 pages (15c); "Research Problems and Methods in Industrial Arts Education": A syllabus and workbook for those preparing to do research, 63 pages (60c); "Theses Pertaining to Industrial Arts Education": Annotated list of more than 100 graduate theses accepted at Iowa State College, 18 pages (20c); "Index to Shop Kinks": More than 2,000 citations to articles describing easy ways of doing hard jobs, 92 pages (75c).

Irwin Auger Bit Company, Wilmington, Ohio, "How to Select, Use, and Care for Bits."

Klise Manufacturing Company, Inc., Grand Rapids, Mich., "The Book of Projects" (one copy free, additional copies 25c).

Kuempel Company, Guttenberg, Iowa, "The Design Book" (free).

Leisure League of America, New York City, "Working With Tools" (25c).

Long-Bell Lumber Co., Kansas City, Mo., "Lawn Furniture Book" (25c).

Lowe Brothers, Inc., Dayton, Ohio, "101 Questions About Painting and Decorating" (free).

Mahogany Association, Inc., 75 E. Wacker Drive, Chicago, Ill., "The Mahogany Book" (one copy free, additional copies 20c); "How to Know Period Furniture" (one copy free, additional copies 3c).

Maple Flooring Manufacturers Association, Stock Exchange Building, Chicago, Ill., "Color Harmony in Floors"; "Flooring of Maple, Beech and Birch."

Martin Varnish Corporation, Chicago, Ill., "The Finishing Touch" (free).

Maydole Tool Corporation, David, Norwich, N. Y., "A Captain of Industry" (free).

McCall Corporation, 230 Park Avenue, New York City, "What to Do Book" (10c).

McCormick-Mathers Co., 1501 E. Douglas Ave., Wichita, Kans., "Instruction and Information Units for Hand Woodworking," including set of tests (80c each — in class quantities, 60c each).

Metropolitan Life Insurance Company, New York City, "Industrial Safety Education in Schools" (free); "First Aid" (free).

Monite Waterproof Glue Co., Minneapolis, Minn., "Glue of the Ancients, Gone Modern" (free).

Morgan-Dillon & Co., "80 Projects and Lessons" ($3 in duplicating ink).

National Hardwood Lumber Association, 2408 Buckingham Blvd., Chicago, Ill., "Rules on Measurement and Inspection of Hardwoods" (25c).

National Lumber Manufacturers Association and the Timber Engineering Company, 1337 Connecticut Ave., Washington, D. C., "Interesting Small Homes" (10c); "Wood Exterior Walls" (10c); "Wood Floors" (10c); "Wood Ceilings" (10c); "Fences of Wood" (10c); "Wood Structural Design Data" ($1); "House Framing Details" (10c); "Stronger Frame Walls" (10c); "Light Frame House Construction" (40c); "Wood Handbook" (25c); "The Story of Wood."

National Paint, Varnish and Lacquer Association, Inc., 2201 New York Ave., N. W., Washington, D. C., "The New Paint, Varnish, and Lacquer Catechism" (free); "Why Paint Peels" (free).

Needle Craft Magazine, Augusta, Maine, "The A.B.C's of Reed Work" (10c).

New York State College of Agriculture, Cornell University, Ithaca, N. Y., "Fitting the Farm Saws"; "List of Publications."

New York State College of Forestry, Syracuse University, Syracuse, N. Y., "Atlas of Commercial Woods" (60c).

Niagara Machine & Tool Works, Buffalo, N. Y., "Handy Reference Booklet" (free).

Northern Hemlock and Hardwood Mfrs. Ass'n., Oshkosh, Wis., "Where and Why Hard Maple in the Industries"; "Seven Vital Factors of Building Construction"; "Timber Tests"; "Selective Logging."

Ohlen-Bishop Company, Columbus, Ohio, "Saw Efficiency."

Oliver Machinery Co., Grand Rapids, Mich., "Installation, Care and Operation of 'Oliver' Circular-Saw Benches" (one copy free, additional copies 10c each); "Proper Installation and Care of 'Oliver' Band Saws" (one copy free, additional copies 5c each).

Pan-American Union, Washington, D.C., "Tropical Hardwoods With Special Reference to Their Uses in American Industries" (5c).

Perkins Co., H. H., 623 Shelton Ave., New Haven, Conn., "Illustrated Instruction Book on Cane Weaving" (free).

Pittsburgh Plate Glass Company, Pittsburgh, Pa., "Practical Suggestions for the Interesting Use of Glass and Paint in Your Home."

Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill., "What to Make" (15c); "Catalog."

Remington Arms Company, Inc., Bridgeport, Conn., "Things to Do With a Pocket Knife" (3c).

Rhoads & Sons, J. E., 26 N. Clinton, Chicago, Ill., "Belt User's Book" (ready soon).

Ritter Lumber Company, W. M., Columbus, Ohio, "Ritter Oak Flooring" (free).

Rogers Isinglass and Glue Company, Gloucester, Mass., Project sheet and sample of fish glue (10c).

Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y., "Handbook of Common Machine Fasteners" (free).

Russia Cement Company, Gloucester, Mass., "Glue Facts" (free).

Sargent & Company, P. O. Box 1940, New Haven, Conn., "Standard Steel Squares" (free).

Simonds Saw and Steel Co., Fitchburg, Mass., "The Band Saw" (free); "The Circular Saw" (free); "Woodworking Saws & Machine Knives" (free); "Methods of Cutting Metal" (free); "File Catalog" (free).

South Bend Lathe Works, South Bend, Ind., "How to Run a Lathe" (25c).

Southern Cypress Manufacturers' Association, 722 Barnett National Bank Building, Jacksonville, Fla., "The American Cypress and Its Uses"; "Pecky Cypress — What It Is and How to Use It"; "Tidewater Red Cypress for Interiors"; "How to Properly Paint Exterior Woodwork"; "Why Cypress Is Resistant to Termites"; "Good Bungalows for Good Birds — Working Plans for 20 Bird Houses" (10c); "Current Grading Rules" (10c).

Southern Pine Association, New Orleans, La., "Standard Specifications for Grades of Longleaf and Shortleaf Southern Pine Lumber and Timber" (free); "And Now Dry Lumber" (free); "15 Cardinal Points of Correct Frame Construction" (free); "Southern Pine Farm Buildings" (free); "Architects Specification Manual for Residences" (free); "Questions Before the House" (free).

Southern Hardwood Producers, Inc., Maritime Bldg., New Orleans, La., "Red and Sap Gum from Southern Hardwood Forests" (free); "Oak from Southern Hardwood Forests" (free).

Standard Varnish Works, 2600 Federal Street, Chicago, Ill., "Architectural Varnishes, Stains, Fillers, and Enamels."

Stanley Rule & Level Plant, New Britain, Conn., "The Steel Square" (free); "Expert Soldering" (free); "The Joy of Accomplishment" (free); Stanley Tool Catalog No. 34A" (free); "16 Wall Cards Illustrating 32 Tool Charts" ($1.50 per set); "Tool Guide," containing same information as charts in book form (single copies, 25c — ten or more, 15c); "Sixteen Things to Make in Your Home Work Shop" (single copies, 10c — ten or more, 5c).

Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., "Handy Books—Price List" (free); "American Cypress and Its Uses" (5c); "Bibliography of Publications" (5c); "Guidebook for Identification of Woods" (30c); "Report of Conference on Utilization of Forest Products" (20c); "How Public Forests are Handled" (5c); "Timber: Mine or Crop" (15c); "Idle Land and Costly Timber" (5c); "Identification of Furniture Woods" (25c); "How Lumber is Graded" (5c).

The Texas Company, 135 East 42nd St., New York City, "Lubrication — Essentials of Lubrication in the Woodworking Industry" (free).

Thurston Supply Co., Anoka, Minn., "Hard-to-Get Materials" (free).

Thayer and Chandler, 910 W. Van Buren St., Chicago, Ill., "The Idea Book" (free).

Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill., "Electric Service With Safety" (free); "List of Inspected Fire Protection Appliances" (free); "Inspected Gas, Oil, and Miscellaneous Appliances" (free); "Appliances Inspection for Accident Hazard" (free); "Inspected Electrical Appliances" (free); "Inspected Household Electrical Appliances" (free).

U. S. Department of Agriculture, Office of Information, Washington, D. C., "Care and Improvement of Farm Woods" (Free); "Glue, Plywood, and Coatings" (free); "Structure and Identification of Woods" (free); "Key to Woods Used for Furniture" (free); "Drying of Plywood Panels" (free); "Kiln Drying Handbook" (free); "Work of the U. S. Forest Service" (free).

Universal School of Handicrafts, Inc., Rockefeller Center, 1270 Sixth Avenue, New York City, "Synthetic Amber Manual of Instructions" (25c); "Chip-Carving Leaflet" (15c); "Manual on Inner-Tube Toys" ($1); "Manual on Card Weaving" ($1) "Supply Catalog" (free); "Manual on Non-Firing Clay" (25c).

Walker-Turner Co., Inc., Plainfield, N. J., "The Lathe" (25c); "The Band Saw" (25c); "The Drill Press" (25c); "The Bench Saw, Jointer, and Shaper" (25c).

Wallace & Co., J. D., 134 S. California Ave., Chicago, Ill., "From the Master Cabinetmakers to Woodworking Machinery" (free); "Cardalog of Machines" (free).

Western Pine Association, Portland, Ore., "Western Pines"; "Wood Turning in the Home Workshop" (10 copies or less, free; 11 to 35, 5c; 36 or more, at Portland, 3c); "Wood Carving for Pleasure" (10 copies or less, free; 11 to 35, 5c; 36 or more, at Portland, 3c); "Plan Book for the Boy Builder" (12 copies or less, free; 13 to 49, 3c; 50 or more, at Portland, 2c).

Weyerhaeuser Sales Company, St. Paul, Minn., "The High Cost of Cheap Construction" (free); "Standard Specifications for House Framing" (free); "Improved Lumber for House Construction" (free).

Wild, H. L., 510 East 11th St., New York City, Jig Saw Pattern price lists and catalog (on school stationery).

Wood, Ivan D., University of Nebraska, Lincoln, Nebr., "Suggestions for Mixing and Applying Paints and Other Wall Finishes" (free — distribution limited to Nebraska).

Woodworker's Tool Works, 222 S. Jefferson St., Chicago, Ill., "Crescent Woodworking Machinery for Small Shops" (free).

Wright, F. E., Cornell University, Ithaca, N. Y., "Your Money's Worth in Furniture" (4c — free to residents of New York State).

Yates-American Company, Beloit, Wis., Bulletins on machines (free).

Zinsser & Co., William, 516 West 59th St., New York City, "The Story of Shellac" (free).

Accuracy in Mechanical Drawing

Stanley S. Radford

Engineering School,
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E. Lansing, Michigan

A useful and usable method of checking and grading drawings.

The mechanical-drawing teacher has an exceptionally fine opportunity to develop the quality of accuracy in all types of students. Accuracy, as a quality of character or a work habit to be developed in every student, is of prime importance and a worthy objective. In a previous article published in this magazine,* the writer outlined a system of grading each job on the basis of (1) knowledge, (2) technique, and (3) citizenship.

Student success in the future business, professional, and industrial life of any community is determined largely be a well-balanced personality acquired through development of his character, knowledge, and techniques, in the classroom, school shops, and laboratories, and in practical experience gained outside the secondary school or the college.

Technique in drawing depends directly upon the student's accuracy in thought, observation, and execution of the drawing. The method of checking student drawings for errors which follows is a systematic way of teaching accuracy, and at the same time a way of determining an *accuracy or technique grade.*

Mechanical drawing, better perhaps, than any other shop subject, lends itself to teaching accuracy in that mistakes made on one drawing can be pointed out and the student can avoid making the same mistakes on the next drawing. This procedure is and can be followed in shop subjects other than drafting to a certain extent on various kinds of projects, but the mistakes made in the finished work are not apt to be so apparent to the student and not so easy to correct as in the case of errors on a mechanical drawing. What is the present procedure or practice of instructors in checking and grading drawings?

*Grading Mechanical Drawing, p. 377, Dec., 1936.

Some Methods of Checking

Many times, due to large classes, instructors are faced with the problem of checking and grading a large number of drawings and must at times do a hurried or quick job of checking in order to keep up with the volume of work constantly coming in. Some instructors follow the practice of checking the drawing during the class period at the time it is completed and turned in by the student. When this is done, no matter how alert the instructor may be, a thorough job of checking is seldom achieved, due to interruptions by students in the class with questions, etc. Other instructors adhere to the practice of checking and grading the drawings during free periods, at the end of each day or week, indicating errors by check marks ($\surd$) on the drawing. This is a better practice in that a more thorough job is likely to be accomplished. While check marks point out the frequency of errors and where they are, it is apparent that often students do not know what the errors are or how to correct them.

Often students will not ask the instructor as to what the specific mistakes are, or take the trouble to find the corrections in a text or reference book. In case of many mistakes on a drawing, students frequently are hesitant to approach the instructor with inquiries as to each mistake, and if they did, with many students in the class making inquiries, much of the instructor's time would be spent in explanation of mistakes made in each individual case. Even though the use of time for this purpose is seemingly justifiable, the fact remains that generally the mistakes are pointed out either individually or to the class as a whole *orally.* A few of the oral corrections may be absorbed by the students, but one is safe in believing that oral corrections relative to numerous mistakes made on drawings by beginning students are not likely to "stick" or carry over for application on succeeding drawings by a majority of the students in an average class.

It will be found on careful observation in any class in drafting, that there are some students who make the same error on successive drawings, no matter how carefully the instructor may point out corrections to be made on each drawing. It is true also that we can logically expect beginning students to make mistakes in the application of the fundamental elements of a drawing, such as freehand lettering, accurate measurement, projection, and dimensioning. A thorough mastery of these fundamentals requires constant practice, application, and repetition on a variety of projects until the student acquires skill in lettering, measuring to scale, the power to visualize, and judgment in placing and giving dimensions accurately.

There are many errors that are constantly and repeatedly made by students

on successive drawings that could and would be corrected by them provided the instructor is able to point out specifically all the errors in each individual case. Students as a rule will try to avoid making the same mistake twice. They will make every effort to correct their errors if they know where or what the errors are, if they are given time to make the corrections. In industrial practice, one error made by a draftsman may be very costly, and the same error made repeatedly would be quite likely to cause such a workman to lose his job. There are many practical illustrations of this point which may be used to impress the students with the prime importance of accuracy in their work. A beautiful drawing in appearance, so far as the quality linework, lettering, etc., may be full of mistakes in projection, in not being laid out to scale, or cause plenty of trouble by inaccurate dimensioning or omissions. How can these errors be detected and systematically pointed out to the student?

Industrial Practice in Checking

In the commercial drafting room, the practice is to have an experienced draftsman act as "a checker." The checker may or may not use a check list of errors to check the drawing but in any case, he will thoroughly check for errors in projection, dimensioning, and in the design of project as to its construction, appearance, and utility. He gives his time almost entirely to accurately checking the drawings and tracings turned in by the various draftsmen before blueprints are made and sent to the factory shops for use there in making the product. If the drafting-room personnel is not large enough to warrant having a full time "checker," the practice of having the more experienced draftsmen check the apprentice draftsman's work for errors is followed, or experienced draftsmen often check each other's work before allowing it to go to the shops for production work.

In spite of this "check and double check" system employed in industry, errors often *get by* and are found *on the job* by workmen. Sometimes the errors are discovered and corrected before they become serious, but often the error means repair, replacement, or perhaps even a complete alteration before the product can be completed. All this involves trouble, time, and loss of money to the employer. *The necessity of teaching students to be accurate as well as neat in drawing, therefore, is apparent.*

The Instructor's Problem in Checking

The point to be observed is that if mistakes *get by* experienced draftsmen and checkers who usually give their undivided attention to do a thorough job of checking the drawing for errors, how much more likely it is that mistakes may be overlooked by the busy instructor, who is responsible not only for checking or verification of results, but for a number of major problems such as presentation, explanation, inspiration, and guidance of inexperienced and inaccurate beginning students. The instructor is concerned with the problem of checking a much greater volume of work than the checker in the average industrial drafting room. In industrial practice, it is seldom that one checker has to check and supervise the work of 10 men, and in most cases, it will vary from 1 to 6 men.

In various types and kinds of schools, the classes vary in size from 15 to 35 students, the average class load varying from 20 to 24 students. Length of class periods vary from 1, 2 and 3 hours, with classes meeting 3, 4 or 5 times per week, depending on the length of period used. It is reasonable to say that the teaching load of the average instructor will vary from 27 to 30 clock hours per week.[1] The instructor with a long class period (3 hours) will not have as many students but the volume of work to be checked will be about the same or more than that of the instructor with more students operating on a 1-hour-period basis. In either case, it is readily apparent there will be from 50 to 150 or more students constantly turning in drawings each week for checking and grading.

How can the busy instructor do a thorough, quick, and accurate job of checking beginning students' drawings that are likely to be full of mistakes? *How can mistakes that are commonly made by students be systematically pointed out, so that each individual student will recognize the error, know what is wrong, and how to remedy it on his next drawing?* Is it possible to develop a method of verification of student drawing work that will make the errors apparent to the individual student?

A Systematic Method of Checking

In answer to these questions, the writer has been experimenting with the development of a more systematic and accurate method, which would, at the same time furnish a quick and convenient way of pointing out errors and of grading student drawings. The following method is submitted after thorough test, revision, and usage in regular classroom work for the past ten years, in the following types of schools — Saginaw High, Reo Motor Car Apprentice School, Arthur Hill Trade, and more recently with students in beginning engineering drawing classes at Michigan State College. It is hoped that the guide for checking errors will be utilized to advantage by teachers in both secondary schools and advanced institutions of learning.

[1]Based upon "A Survey of Drafting Curricula and Class Room Methods in Representative Smith-Hughes Trade and Vocational Schools of the United States," Master's Thesis by Stanley S. Radford under direction of Dr. George E. Meyers, Vocational Education Department, University of Michigan, 1934.

Explanation of the Guide

The foregoing checking list consists of errors most frequently made by drafting students and the errors indicated by letter symbols are weighted with a maximum number of deductive points based on the frequency with which the error occurs in student work and its relative importance. For example, under (1) Layout, it will be found that the errors *a*, *c*, and *e* will occur more frequently than errors *b* and *d*; (2) Linework, the errors *f*, *g*, and *i*, more than *h*, *j*, *k*, and *l*; (3) Dimensioning, the errors *n*, *o*, *p*, and *s*, more than the others in this group; and (4) Lettering, the error *z* slightly more than the others in this group. It will be noted that in most instances, the errors which occur with greater frequency are apt to be major errors or those of a more serious nature on the drawing.

The "alphabet of errors" is divided on a 4-point basis with which the student is primarily concerned in making a mechanical drawing, namely, (1) Layout, (2) Linework, (3) Dimensioning, (4) Lettering, these phases being weighted with 20, 35, 30, and 15 points, respectively, to indicate a perfect score on each according to relative importance. It will be noted that neatness is provided for under (1) Layout, symbol *e*. If it seems advisable to the instructor, especially in dealing with older students, to insert the element of time into the picture, this can readily be done by adding the following statement to the guide, for example: Five points will be deducted from the total score made on a drawing for each class period required to complete it beyond the final *due date*.

There is some flexibility permitted in the deduction of points on each letter symbol. For example, the instructor may mark off 1, 2, or 3 points out of the 6 allowed, depending upon the seriousness of the error or the desirability of distributing the 6 points in case the same error is repeated in a number of places on the drawing. The maximum penalty to be marked off would be all 6 points. This same practice should be followed in deducting points in the case of each letter symbol or error listed. This procedure permits accurate checking of the drawing in every case and makes it possible to vary somewhat the total score earned in

case it seems desirable not to discourage the beginning student by too close grading. If the guide is used in checking drawings made by younger students, it would be wise not to mark off the full penalty or maximum number assigned with each symbol. In case of older students, the instructor should use discretion in how closely he marks individual student's work, keeping in mind the welfare of each student at all times. In general, however, it is well to follow the practice of deducting points on a uniform and systematic basis, alike for all, basing deductions on the seriousness of the error and the number of times the same error occurs on the drawing.

Mechanical Drawing

Guide for Checking Errors

Points Deductive	Symbol	Errors	Perfect Score
		1. LAYOUT	20
6	*a.*	Views or lines on views not laid out to scale.	
2	*b.*	Views improperly located with respect to each other.	
4	*c.*	Unbalanced spacing or arrangement of views of a part or of several parts on same drawing.	
2	*d.*	Title block or bill of parts not laid out to scale, or information given incorrectly or omitted.	
6	*e.*	Lack of care in layout — drawing is dirty, shows finger marks, dirty spots, ink spots, frequent erasures, etc.	
		2. LINEWORK	35
10	*f.*	Visible edge lines are incorrect or omitted.	
10	*g.*	Hidden edge lines are incorrect or omitted.	
2	*h.*	Hidden edge lines are drawn incorrectly, or uneven in length of dashes and space between dashes.	
6	*i.*	Improper line contrast — weight of lines incorrect — too heavy, too faint, uneven, or ragged and blurred.	
2	*j.*	Center lines are made incorrectly or omitted.	
3	*k.*	Corners and intersections are poorly made.	
2	*l.*	Crosshatch lines indicate wrong materials or are improperly spaced or omitted in section views, breaks, etc.	
		3. DIMENSIONS	30
3	*m.*	Extension or witness lines and leader lines are drawn incorrectly or omitted.	
4	*n.*	Dimension lines are drawn incorrectly, crowded, unevenly spaced, or improperly located.	
6	*o.*	Size or location of dimensions are incorrect or omitted.	
4	*p.*	Dimensions are repeated on adjacent views, or unnecessary dimensions are given.	
2	*q.*	Figures or fraction bars are carelessly or incorrectly made, or figures are too large, or too small, or placed improperly on or across lines.	
2	*r.*	Arrowheads are made or placed incorrectly, or do not touch extension lines, or are omitted.	
4	*s.*	Notes are given improperly, left out, or lettering in notes is too large or too small.	
2	*t.*	Dimensions do not read from the bottom and right-hand side of the drawing.	
3	*u.*	Finish, fillets, and rounded corners not shown or specified correctly.	
		4. LETTERING	15
3	*v.*	Slant of letters not uniform.	
3	*w.*	Width of letters varies too much.	
3	*x.*	Height of letters not uniform.	
2	*y.*	Spacing between letters and words incorrect.	
4	*z.*	Letters are incorrect as to shape, appear uneven and shaky, or are too heavy or too faint.	

Utilization of the Guide

To use the guide, the instructor should carefully explain each error listed so that all students will know what to avoid and the manner in which the points are deducted. A number of the guides should then be posted in convenient places on the walls of the drawing room, where students may take their drawings and look up the *error which is pointed out to them by the number of points, and the letter symbol being placed directly on the error on the face* of the drawing with a red pencil (Figure 1).

As to procedure in checking, the instructor should first check the drawing in the order in which the letter symbols are listed — *a, b, c, d, e, f, g,* etc., marking the symbol directly on the error on the face of the drawing. The total numerical score earned by the student is quickly determined by adding the total number of points deducted and subtracting from 100. For example in the foregoing case, the points deducted are added — 4*c*, 4*f*, 2*i*, 4*o*, 2*n*, 2*l*, 2*d*, totaling 20 points. 100 — 20 = 80 points earned or the *a* numerical score which corresponds to a letter grade of "C" according to a grading scale commonly used in many school systems, in which

A = 96–100, B = 90–95, C = 80–89,
D = 70–79, F = 70, X = Condition.

The letter grade "C" should then be marked in the lower right-hand corner of the drawing. In this manner an *accuracy or technique grade* is determined quickly and systematically. As the instructor uses the guide more, he becomes familiar with the "alphabet of errors," the symbols, the method of deducting points in each case, and the scoring of results. The time spent in pointing out errors and in grading is thereby greatly reduced because of increased ability and speed of work in using the guide as a working tool.

A further refinement of the above method of pointing out errors, scoring, and grading is to have a rubber stamp made up as shown in Figure 2.

ACCURACY GRADE — C
Free-hand Sketch
Mech. Drawing ←
Tracing

No.	Point Basis	Perfect	Actual	
1	Layout	20	14	4-c, 2-d
2	Linework	35	29	4-f, 2-i
3	Dimensioning	30	22	2-l, 2-n, 4-o
4	Lettering	15	15	
Total points earned		100	80	

Fig. 2. Rubber stamp

This form is stamped on the back of the drawing and the various points and letter symbols that have been marked on

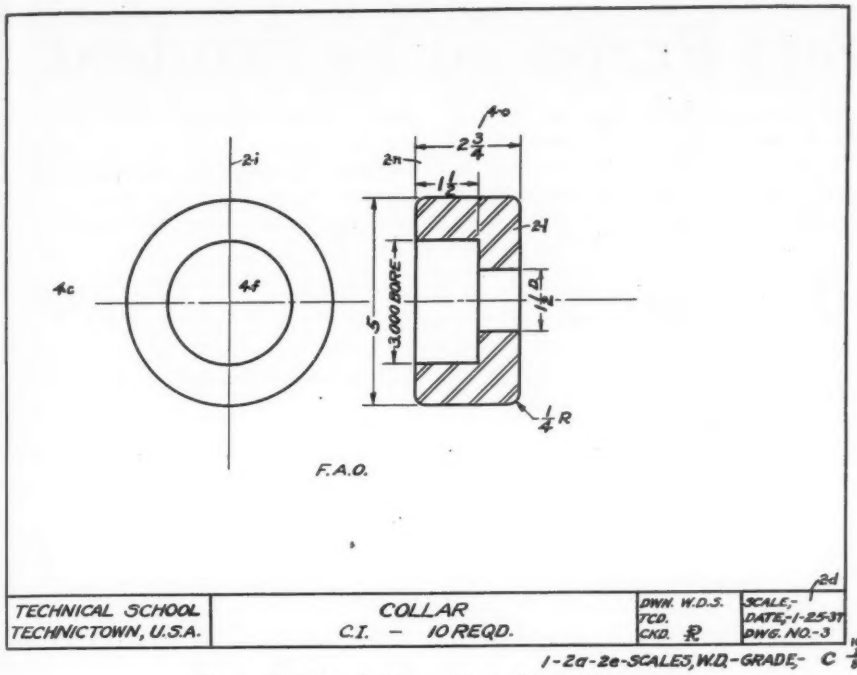


Fig. 1. Drawing showing method of indicating errors

the face of the drawing, are collected and marked opposite each point (1) Layout, (2) Linework, etc., indicating the number of points to be deducted from the perfect score as shown above in each case.

Pertinent Observations

Upon first glance, some instructors may think the method too complicated, and that it takes too long to administer with the volume of drawings to be graded. In this case, the writer hopes that they will give it a fair trial of at least 2 or 3 weeks. At least that length of time will be needed to become thoroughly familiar with its use and value as a working tool. A certain amount of practice is necessary before the instructor becomes efficient in its use. The instructor will find that the effort made will be rewarded with increased satisfaction in that — students tend to become more accurate each day or from one drawing to the next: grading is accomplished on a more uniform basis, being done "objectively" rather than "subjectively." The students quickly realize that their drawings are graded on the same point basis for all and that improvement is a matter of careful observation and correction of mistakes from one drawing to the next; that it is a matter of "earning a grade" or improving the accuracy of their own work, rather than a feeling that too often exists that the instructor gives out grades by favoritism to some at the expense of others.

Conclusions

There are a number of significant conclusions as a result of this study.

1. The degree of success that the instructor has in teaching all types of students to be accurate in making mechanical drawings is dependent directly on how thorough a job he does in checking and pointing out the errors on the drawings.

2. The guide for checking errors provides a thorough, quick, and objective method of grading mechanical drawings.

3. The guide for checking errors provides a uniform basis of checking and grading drawings for use by a number of instructors doing the work in the same school system or school. Its use would eliminate the wide variation in checking and grading methods used at present by instructors in the same school, school system, or in various school systems.

4. This method teaches the value of an accurate drawing or a *mastery of drawing* is emphasized rather than striving purely for *grades and credits*. The student can see just how inaccurate his work is and with this revelation there usually comes a desire for improvement. As a result of careful observation, effort, and correction of mistakes, grades or marks gradually improve as a by-product of his work.

5. The guide for checking errors and its use eliminates most of the questions which students would otherwise have to ask, brings about a more rapid development of the quality of accuracy, and saves the time of the instructor in pointing out and explaining errors orally throughout the course. The student cannot say "You didn't explain that to us in class, or we didn't understand this or that" as the daily use of the guide points out the errors in written form, with constant usage by the students until they thoroughly understand all the errors involved and *play the game* according to the *alphabet* as outlined. Student reaction toward the use of the guide, when fairly administered, is highly favorable.

6. The guide for checking errors can be used equally well with students of all ages in that flexibility in the matter of deductive points for errors is permitted the instructor doing the grading in a given situation. The guide is adaptable for use in different types of schools with students in various age and ability groups.

7. All teachers of mechanical drawing need to stress the development of accuracy in all types of students as this quality is of prime importance in drafting practice and in all other phases of industrial and technical work of any kind.

Printing in the Junior High School

Frank Di Giacomo
Brooklyn, New York

A set of objectives for the print-shop teacher.

Industrial-arts printing, besides serving a guidance function for discovering special aptitudes in boys and acquainting them with a major occupation through a short exploratory course, also has the following objectives to justify its existence in the school curriculum:

1. To cultivate an intensive study of spelling, paragraphing, capitalization, and division of words.

2. To develop an appreciation for form, color, design, and arrangement.

3. To provide adequate opportunity for concrete applications of arithmetic.

4. To train the boy in fine co-ordination of hand, eye, and brain.

5. To afford an opportunity for the boy to explore and try himself out in one of the major occupations to discover interests and aptitudes.

6. To develop an avocational interest in printing and to stimulate leisure-time hobbies involving printing.

7. To develop an appreciation for good printing and to make an intelligent consumer of printing.

8. To serve as a definite preparation for an occupation for those who must leave school early.

9. To serve as a correlating medium of other subjects and interests both in and out of school.

10. To help develop good social habits and co-operation, which will aid the boy in adjusting himself better to out-of-school life.

Operation Sheets Prepared by Student

Hirschel M. James

Alleghany High School,
Cumberland, Maryland

Getting the student accustomed to solving his own shop problems.

Industrial arts is an area in general education in which the attempt is made to acquaint the individual with the civilization of which he is a part. Life experiences are brought into the classroom through the media of tools, processes, and materials. These experiences must be arranged and presented in such a manner as to stimulate creative thinking and to introduce problem solving in as natural a setting as possible. These experiences must teach the student how to think, as well as to enable him to construct things of materials.

Systematic planning is essential to the success of the problem. The steps which are a part of the general procedure must be organized in proper sequence so that the student may visualize the relationship each bears to the other. The organization of these steps is an important part of the problem, requiring the student to draw upon accumulated learning, and to constantly review past experiences. To visualize the combination and sequence of the manipulative operations is not sufficient for the complete solution of the problem. He must also have knowledge of the technical and related information, making possible the development of the materials and equipment used in the problem.

Experiences from the industrial-arts classes alone will not be sufficient for all this planning and understanding. He will gather information from the academic subjects and apply this information to his problems in the industrial-arts work. Gradually there will be a linking together of the learning activities in the school, each strengthening the other and motivating and challenging the student's interest. He will then be able to visualize the possibilities of self-advancement through school activities, and the need he will have for each in adapting himself to this industrial civilization.

The accompanying form for the preparation of the operation sheet is found to be cumulative in value as the student's experiences are enlarged. The form is not intended to be complete, but should serve as a guide in stimulating thought and questions. A harmonious relationship is created among the students, pupil personnel, and the instructor. There is no delay due to inability to visualize the next step, and the frequent checking at designated intervals reduces the mistakes, emphasizing good workmanship.

The applications for this form are several. It may be filled out by inexperienced students from a master copy, or from dictation. Soon the student will be able to prepare the form with little aid from the instructor, seeking only aid in

ALLEGANY JUNIOR-SENIOR HIGH SCHOOL

DEPARTMENT OF INDUSTRIAL ARTS

BENCH METAL WORK

Student's Name. Harold Anderson Class. 9-8

~~Project or~~ Job. Base of Paper Punch Date. Nov. 3. 1936

~~Project or~~ Job Grade. B Total Lesson Grade. 260 Date Finished. Dec. 1 '36

Instructions:
Column "I" is to be checked by the instructor or class inspector at designated intervals, indicating the acceptance of the work as satisfactory to that step. Column "P" is to be filled in by the student. From column "U" select the key number of the unit operations and arrange them in column "P" in the order in which these operations will be performed. These numbers will be repeated as often as the unit operation is repeated. Fill in the blank spaces with the correct word or figure which will make the statement of the unit operation complete.

I	P	U	UNIT OPERATIONS
K	4	1.	Prepare the marking surface with copper sulphate solution
V	6	2.	Cut stock material with ..... Select blade ..... T to inch.
V	3	3.	Instructors OK.
V	28	4.	Make bill of materials, using form on page No. 2.
V	12	5.	Layout drill holes ~~with~~ 3/8 ....? center punch.
V	7	6.	Make working drawing of job or project.
V	16	7.	Class inspector's OK.
V	15	8.	Using the prick ...punch, mark centers for scribing circles with dividers.
V	29	9.	Using template No. 42, transfer layout lines to material with scriber
V	7	10.	Draw line C-D ..... at an angle of 90°, using the protractor
V	3	11.	Countersink holes No. ..... for ..... with ..... countersink.
V	1	12.	Cut ..... with 3/8" flat ..... cold chisel.
V	9	13.	Anneal ..... by heating to a ..... heat.
V	8	14.	Cut ..... threads with .....
V	5	15.	Check accuracy of ..... with .....
V	10	16.	File ..... using a 12", ...
V	7	17.	Drill hole No. ..... for ..... " tap with ....." ..... tap drill.
V	3	18.	True surface ..... by scraping with ..... scraper.
V	23	19.	Drill holes No. ..... with 1/4". straight shank twist drill.
V	3	20.	Assemble parts ..... using .....
V	19	21.	Ream hole No. ....., using a ..... reamer.
V	23	22.	Dress parts ..... with electric grinder, using ..... wheel.
V	29	23.	Counterbore hole No. 8 ...to a depth of 1/2", using 1/2" counterbore
V	3	24.	Temper piece ..... by heating to ..... heat and quenching in .....
V	30	25.	Case harden piece ..... by the application of .....
		26.	Bend .....
		27.	Finish with No. 2/0 and No. 0 emery cloth
		28.	Remove burrs on corners with fine file. Use 6" T. file.
		29.	File surfaces smooth with 8" No. 2 cut flat file. Blade
		30.	Purpose. Paper punches for .....

Page No. 2

BILL OF MATERIALS

Name of Material	Size	Cost per	Amount Required	Cost
Cast iron	5"x2½"	3.5¢ lb	3 lbs.	10¢
Machine Steel	3/8"x 5" round	5¢ ft.	3"	3¢

Instructor's OK. ( ) for the filling of this requisition. Total Cost $ 0.13

New Words for your shop VOCABULARY

1. parallel
2. automatic
3. surveyor
4. device
5. pitch
6. etching
7. micrometer
8. apprentice
9. construction
10. avocational
11. superintendent
12. protractor.

This Job or Problem has given you a chance to apply some of the principles and information learned in other subjects. List those which come to your attention under the heading of the subject where this information is found.

Arithmetic: Use of protractor in measuring an angle.
Arithmetic: Calculating bill of materials
Social Studies: Study of the making of cast iron.
Chemistry: The alloying of carbon and iron
Mechanics: The principle of the inclined plane and the lever.
English: The writing of an application letter.

RELATED and TECHNICAL INFORMATION Assignment

Unit No.	Name of Unit	Grade
19	Drills and Drilling	90
20	Abrasives and Grinding	85
21	The Identification of Metals	85

Operation sheet as prepared by a student

the arrangement of order of the units. All students cannot be expected to react with equal ability in using these forms. As the work advances, so will the problem of preparing the operation sheet. Some projects may involve the organizing and correlating of two or more activity forms. Most students will be able to prepare the single form at the close of the first year. During the second year, equivalent to the ninth or tenth grades, all students should be able to prepare the operation sheets for jobs that have been a part of their past experience from demonstration or practice.

This form creates a shop record. As soon as the unit operation has been accepted as satisfactory, the student may fill the record of his progress on the shop progress chart. The filling of the blanks creates a work sheet on consumer's information. Special attention is given to kinds, types, and sizes of tools and materials used in the problem.

Teaching the Job Case to Young Students

C. K. Lush
Industrial-Arts Assistant,
Minneapolis, Minnesota

A method of presenting elementary printing to junior-high-school pupils in a story-telling technique.

The following may be used as a lecture to beginning students in junior-high-school printing. This material has been found to build interest in the subject of printing, introducing the student to new terms, new meanings to common words, and a new system of measurement. The beginner enters a new world and finds the subject very different from any which he has previously taken.

The pieces of type in a job case may be thought of as a large family, all living in a suite of rooms of a large apartment building called a type cabinet. (See Figure 1.)

You will need to memorize the location of each character. This will not be difficult if you use the following memory aids. First notice that there are two heavy walls separating the apartment into three sections. Now look at line of type shown in Figure 2.

It consists of a group of workers from the job case, led by their captain the *W*. These capital letters are kept in the third section, and are placed in alphabetical order when reading from left to right, with the exception of the *J* and *U*, which come after the *Z*. These captains of our family are the largest characters, and their main duty is to lead each little line of type when they are working. In Figure 3 is shown a blank floor plan, or case sheet. You are to fill this out in learning the case. Fill in the names of the members of your family as we talk about them. By repeatedly doing this, you will eventually know the room location of each member. Fill in the capitals, or the "upper case," as printers refer to them, remembering to place the *J* and *U* after the *Z*. Add the ampersand (&) and the — well, look who lives in the last room — the triplets! A ligature is a piece of type cast with two or more characters. The *triplets* like to work in a *waffle*, and they usually win out in a *raffle*. There is another set of *triplets* in our apartment which are sometimes con-

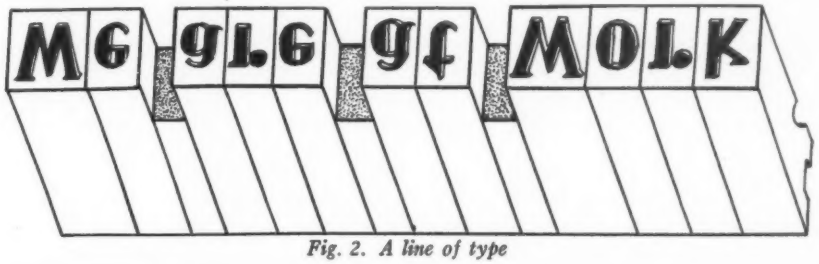


Fig. 2. A line of type

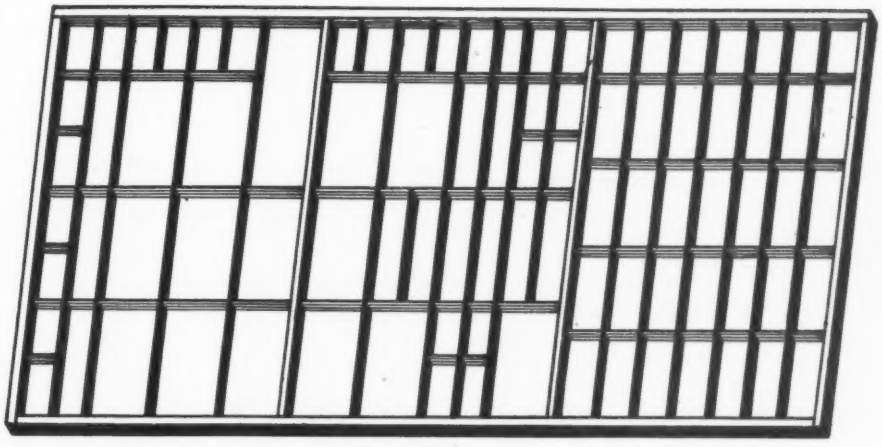


Fig. 3. Empty case

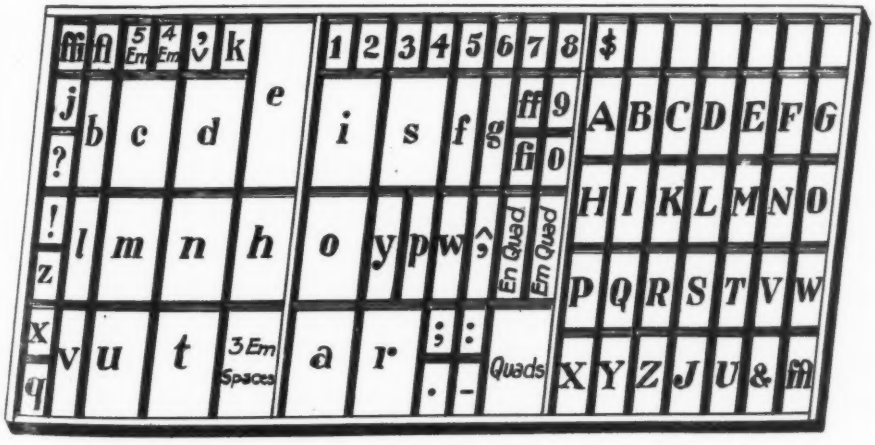

ffi fl 5 Em 4 Em ? v k e
1 2 3 4 5 6 7 8 $
j b c d i s f g ff 9
? fi 0
A B C D E F G
! l m n h o y p w ; En Quad Em Quad
z H I K L M N O
P Q R S T V W
x v u t 3 Em Spaces a r : Quads
q . -
X Y Z J U & ffl

Fig. 1. The California Job Case

fused with these, the *ffi*, which is given a room as far from the *ffl* as possible, in the far upper left-hand corner of the apartment (almost like throwing from first base over to third).

Before we talk about the rest of the *twins* and *triplets*, let's take care of our money. The dollar sign is placed way up in the first empty room in this third section with the capitals.

We have now memorized the third section of the case. The first two are most easily learned together. First note that the rooms are not all the same size; some are large, and some small. The largest room is for the *e*. This letter is used more than any other. Yes, I suppose you have noticed that the lower case, or small letters, are not placed in *a, b, c* order. Friends wish rooms together, and consequently the friends who work and travel together a great deal are grouped in the center of the apartment. We see these friends together at work a great deal in words such as *he, is, oh, bed, ran*, etc. Note how closely their rooms adjoin. At first you will wonder if it is possible to learn where all these people live.

When you move to any new and strange city, you soon learn the names of those about you, then your neighbors in the same apartment, if that is where you reside, then later on you become acquainted with even the people in the neighborhood, and this is true for the beginner in a printshop. We first learn where each of the characters are placed in the case, then we gradually become acquainted with other type families of various sizes and styles.

Begin with the left vertical row below the *ffi*. These are the letters with a dot over or under them (with the exception of the *i*). Here is a way to remember which comes above the other, the *j* or the *?*. If they were made of twisted wire, you could hang the *?* on the hook of the *j*. The *j* then must be above the *?*, because they cannot be hung right side up the other way. Suppose you should see such a thing; it would really bring an exclamation! Now the last three are not so easy to remember, *z,x,q*, so just repeat them to yourself over and over again, *z,x,q, z,x,q, z,x,q*, etc.

Fill in these, *b, c, d, e, i, s, f*, and *g*. Let each letter stand for a word, and you can get this sentence, "*b*e careful *d*riving elephants *i*n small *f*ord garages." Notice that the letter *e* has the largest room. Why?

Go to the next row below, *l, m, n, h, o, y, p, w*, and the comma. Let *l, m, n* stand for *lemon*, the *h* and *o* for *hop over* (hop over the heavy wall), and *y, p, w*, and the , for "you punctuate with , , , , , , ," or else use (for the entire row) "*l*et *m*e *n*ow *h*elp *o*ut *y*our *p*unctuation *w*ith *c*ommas."

There is a row left below, the *v, u, t*, and spaces, the *a*, and the *r*. Leaving the spaces for later, these letters might mean, "*v*illains *u*sually *t*ake *a r*ide."

Locate the ligature *fl*, which "*follows 'long*" with the *ffi*; two more boxes for spaces, the quotation marks, then the *k*, which is by the *e*, the "*key*" to the *k*. Put in the numbers, and you now find that your apartment is nearly filled. The *ff* and *fi* twins are placed in the two small rooms remaining near the *f* and *i*. Locate the *semicolon*, and the *colon*, the *period*, and the *dash*. What are those spaces and quads which we have omitted? They are used to separate the words in a line and to make the line the exact length needed.

When entering any foreign country, one must not only learn the language, but also about the different money pieces and their values. Suppose we think of the spaces and quads as money. A dollar is our money unit. Two half dollars equal one dollar, four quarters equal the same, but a two-dollar bill is equal to two dollars. In the *City of Fonts*, the dollar is the *em*-quad. This is a square piece of metal less than type high, used for spacing. (See Figure 4.) The *en*-quad next to it is our half dollar; then two *ens* make one *em*. (See Figure 5.) Take two *ens* and an *em*-quad and test this statement. Below these two quads is the cash drawer containing the larger quads, the *two-em* and *three-em* quads. The *two-em* quad is twice as large as the *em-quad*, corresponding to a two-dollar bill. Try out two *em*-quads to see that they are as large together as the *two-em* quad. There is usually a reason for everything, and it is said that the name *em* originated in this way. The piece of metal which has the *M* on one end was originally square. Early printers filed off the surface of the square *M* characters for spacing material and called them *em*-quads. If you were to draw a vertical line through an *M*, you would form an *N* on the left half. This half of an *em* was called the *en*. Therefore, two *ens* make one *em*. All the quads, then, are located in the middle section of the apartment floor. Proceed to the spaces. These make up the *small change* of our monetary system. The three-*em* spaces would be valued at thirty-three and one third cents, for there are three of them to the *em*. See the pictures below, and you will see this illustrated in Figure 6. Take three spaces of this size and compare them with the *em* quad, our *Font-City* dollar. These three-*em* spaces are the most commonly used, because generally one is used between each word in a sentence. Find the *five-and-four-em* spaces. There are four *four-em* spaces to the *em*, and five *five-em* spaces. As there are four quarters in a dollar, there are four *four-em* spaces to the *em*. These smaller spaces are used to tighten a line of type to make it just snug enough to fill the composing stick.

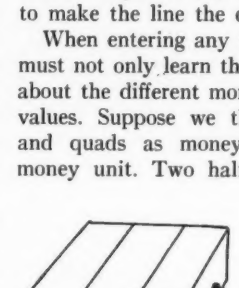


Fig. 4. The em quad is square and not as high as type

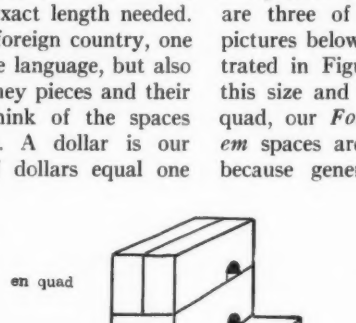


Fig. 5. The quads

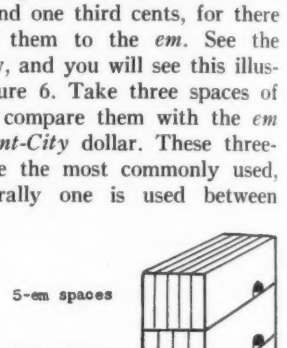


Fig. 6. The spaces

Every room is now filled! Ask for several blank case sheets and practice filling in as many as you can remember. Refer to the memory aid for those you forgot, and try again. Do this until you can pass the test perfectly.

Why Copy?

August Flam

John Marshall High School, Los Angeles, California

An appeal to discard outmoded methods in the drafting room.

There are still teachers of mechanical drawing who believe that the subject can be taught by requiring the pupil to do nothing but copy from completed drawings, or from models which are first measured. Such methods cannot be conceded as being reliable, and can hardly be justified

in an enlightened drafting teacher's class.

An illustration showing the viciousness of such methods was vividly drawn to our attention recently. A pupil from a distant state wished to enter a beginning class in mechanical drawing, about the middle of the semester. He had brought a sample of his work, to show what had been accomplished since the beginning of the semester in his old school. The drawing he showed consisted of two views of a lathe headstock, which were neatly and carefully drawn. The figures were more difficult than anything we had ever attempted before the fourth or fifth semester of drafting. The two views were not, however, in line with each other, and it was noted that on the front view, the pitch circles, or at least what appeared to be pitch circles of meshing gears, were shown by dotted circles. We asked the young man why this was done, and also why the views were not lined up. To our surprise he did not seem to comprehend either criticism. Further questioning brought out the fact that his drawing was an exact copy of a chart which the teacher had placed in front of the class, and required that an accurate copy be made by the pupils, using the dividers and the scale to copy. The youth had never, according to his story, which we have no reason to doubt, heard the term *orthographic projection* mentioned. All the drafting in this particular school, he assured us, was done in that way. The teacher merely graded the drawings as they came in, on the degree of neatness and accuracy of duplication from the original. We would like to believe that such methods prevail in rare instances.

While on the subject of grading, may we add that the practice of accepting a piece of work uncorrected, does not help the pupil to improve. Corrections should be indicated in the presence of the pupil, preferably in colored pencil, and before the drawing is accepted, all the corrections should be made by him, and checked again in his presence by the teacher. Thus when a pencil drawing is ready to pass and be graded, it should be reasonably correct. Therefore when a pupil inks or traces a corrected pencil drawing — if inking or tracing is part of the classwork — the result should be comparatively free from glaring errors.

Copying from models is but slightly less dangerous than copying from drawings. It is indeed true that some thought has to be given to the arrangement of views, and perhaps to scale, location of dimensions, and a few minor matters, but on the other hand there is even less left to the imagination of the pupil than in the case where copying from another drawing is resorted to. That capacity to visualize, which usually exists in pupils to a lesser or greater degree, and which is so vital to successful drafting and designing, does not have any opportunity to manifest itself or grow, when completed models alone are used for reproduction.

Except in the first few days of the beginner's career, there is no merit in copying from a drawing or model, no matter how excellent such drawings or models may be. At the early stage of his development the young draftsman is merely learning the "feel" of things. The proper technique in manipulating the equipment, using the scale, triangles, and T square, sharpening pencils, and drawing the right kinds of lines, may indeed be learned by copying drawings. However, even in this preliminary exercise some type of problem can be injected. As suggestions, a reduction in scale, changes in proportions, changes in location of dimensions, omissions, or additions can and do make the process of drawing of greater interest to the pupil. Starting with straight lines, and winding up with circles and tangents, such preliminary work need never extend over a period of the first ten days of the semester. Thereafter mere slavish copying should be eliminated.

The type of problems that may be presented after such preliminary work are so numerous that it is astonishing that there are teachers who fail to take advantage of them. Assuming that the fundamental principles of orthographic projection have been clearly and simply explained, and assimilated by the class, two views of simple figures can be shown, the missing third view to be constructed by the pupils. This type of problem is most satisfactory; the pupil knows he is getting somewhere, and enjoys solving problems. The joy of discovery incites him to greater effort, and it is surprising what progress can be made when there is such inducement.

There are innumerable problems in auxiliary projection, intersections, developments, sections, half sections, and several types of pictorial representation, offering rich fields in problem construction. In the more advanced courses, there is detailing to be done from the assembly drawing — exactly as in actual drafting-room practice, or assemblies may be made from the details. Later the design of pulleys, couplings, stuffing boxes, universal joints, cams, and spur and bevel gears can all be profitably taught in the high-school drafting class. This is the type of work which appeals to students and keeps them mentally alert and interested.

It is time then to definitely scrap the mere copying in drafting as an antiquated makeshift of an earlier day.

A Desk-Set in Copper—I

Leon H. Baxter

Pawling School,
Pawling, New York

The first of a series on an interesting art-metal project.

The beginner in art-metal work will find the desk set described and illustrated in this series of articles, of which this is the first, most interesting and helpful. It carries a sufficient challenge from the simple paperweight and letter opener on through to the more intricate problems of fitting, bending, and soldering, and in making the inkwell and the stamp box.

The projects proceed in a natural sequence of difficulty, bringing in many and varied steps in metalwork design and construction.

While the writer has used the design of the running deer throughout, this is optional, and any design suitable to fill the given space may be selected.

The set is composed of copper with the deer of brass, attached with soft solder. After all of the separate parts are completed, it will be found that the set possesses an individuality, not found in those on the market, of which hundreds are stamped out from the same pattern.

Soft Soldering

It may be well to devote some space to the subject of soldering. While hard solder may be used, it is more difficult for the beginner and the soft solder answers all purposes in the following projects.

The commercial "half-and-half" solder (50 per cent tin and 50 per cent lead) is very good and the type coming in spools known as wire solder is the easiest to handle. It is obtainable either solid or

with a core of "flux." This flux dissolves the oxides and insures an even spread of the solder itself.

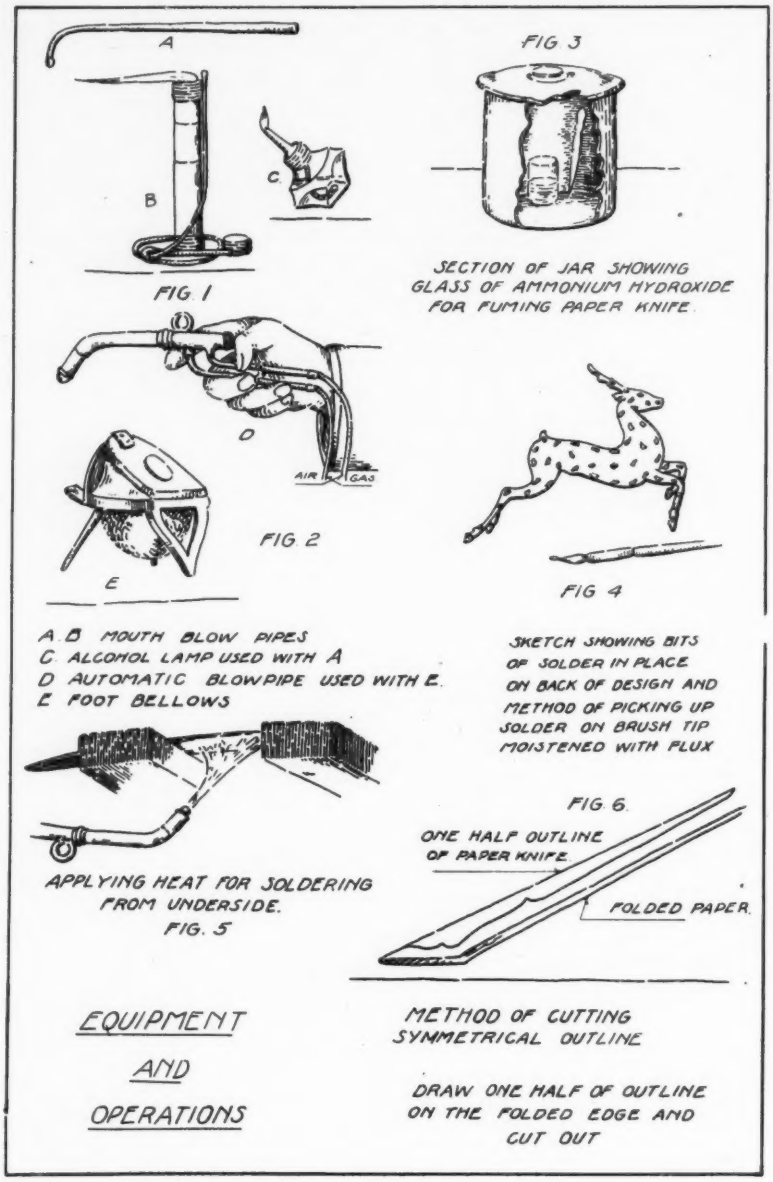
Of all the fluxes on the market, zinc chloride is as good as any and can easily be made by dissolving small pieces of zinc in muriatic acid or hydrochloric acid. Many firms dealing in art-metal supplies have excellent fluxes at a reasonable price.

One of the most important features in soldering is to have all adjacent parts absolutely clean and bright. Successful soldering cannot be done unless careful attention is given to this feature. Next, all parts that contact one another must be good tight joints for satisfactory work.

While a soldering iron, or copper, may be used, it is much more satisfactory to have a jeweler's blowtorch of some type, either mouth or foot power. See Figure 1 on Plate A. For attaching the deer to the various pieces of the set, it is best to hammer a short length of the wire solder very thin. This should then be cut into pieces a little larger than a pin head. After cleaning the underside of the design and the surface on which it is to be placed, apply some liquid flux with a thin, pointed stick, or small paint brush, to the contacting surfaces. Next, pick up on the tip of the brush the small bits of solder and arrange them as shown by Figure 4. Place the design carefully in position and apply the heat. It is important that the metal itself be heated, rather than the solder, so do not direct the flame toward the solder but instead on the metal about it, as shown in Figure 5. The heated metal will melt the solder, and this will run readily along the joint and a thorough contact results. Remove the heat as soon as the solder runs evenly. Pick up the object with a pair of tweezers and cool under water. Dip in a cleaning solution of two-thirds water and one-third nitric acid. This is known as "pickle."

In making the pickling solution, which is best used in a flat glass dish, be sure to pour the water in first. After removing the piece from the pickling solution it must be rinsed thoroughly, being careful not to get the acid on your clothing.

After drying, rub lightly all over with fine steel wool and the work is then ready for the final finishing.


A
B
C
FIG. 1
FIG. 3
SECTION OF JAR SHOWING GLASS OF AMMONIUM HYDROXIDE FOR FUMING PAPER KNIFE.
D
AIR
GAS
E
FIG. 2
FIG. 4
A B MOUTH BLOW PIPES
C ALCOHOL LAMP USED WITH A
D AUTOMATIC BLOWPIPE USED WITH E.
E FOOT BELLOWS
SKETCH SHOWING BITS OF SOLDER IN PLACE ON BACK OF DESIGN AND METHOD OF PICKING UP SOLDER ON BRUSH TIP MOISTENED WITH FLUX
APPLYING HEAT FOR SOLDERING FROM UNDERSIDE.
FIG. 5
FIG. 6.
ONE HALF OUTLINE OF PAPER KNIFE.
FOLDED PAPER.
EQUIPMENT AND OPERATIONS
METHOD OF CUTTING SYMMETRICAL OUTLINE
DRAW ONE HALF OF OUTLINE ON THE FOLDED EDGE AND CUT OUT

Finishing

There are many ways of coloring metal, but to the writer none is so beautiful or satisfying as fuming with ammonium hydroxide. (Strong ammonia.)

Variations in color from all shades of brown to blue and green may be obtained by the following method. Secure a stone crock, large enough to easily hold the object to be fumed, and in it place a common drinking glass about one third filled with the strong ammonia, as shown in Figure 3. Place the objects upright in the jar so as to allow the fumes to strike all surfaces, and then put on the cover and allow it to remain overnight. After removing from the jar, allow the work to thoroughly dry out, as some moisture usually forms on the surface. The next step is to rub lightly with fine steel wool to bring out the high lights on the raised surfaces. Rub the brass design with fine emery cloth and steel wool until it is bright and clean. Coat all surfaces next with ordinary floor wax and rub to a polish with soft cheesecloth. The piece is then complete.

It is often a good plan to melt a small piece of paraffin and cover the brass design with a small brush. This helps to keep the brass from darkening during the fuming process, and it is then more easily cleaned after it is removed from the jar. By very slightly heating the brass design the paraffin will flow more readily. The paraffin is then removed with a knife blade before rubbing with steel wool.

Riveting

In joining pieces of metal together with rivets, it is necessary that all holes coincide exactly and are drilled slightly larger than the diameter of the rivet shank that is to be used. The rivets should pass snugly through each piece and project not more than a scant 1/16 in.

The heads of the rivets must next be placed on something solid. Figures 12 and 13, show how to use the riveting tool.

This tool has a depression in the end in which the rivet head is placed, while the other end of the rivet is hammered flat as shown in Figure 12.

Carefully done, the hammered end is left in a neat and inconspicuous condition. A rivet with the shank projecting through the work more than 1/16 in. is apt to turn over and leave a poor, unworkmanlike job. After flattening with the regular riveting hammer, it is well to use the rounded end of a ball-peen hammer to finish the work so as to match the rest.

For special work, rivets with decorated heads, square, hexagonal, or petal-shaped, may be used. If it is desired that the projecting end of the rivet should match the rounded head, a tool, similar to the one shown in Figure 14, is used. These come in various sizes with a hollow cut in the end which is placed over the rivet end giving it a domed finish.

Engraving and Chasing

Engraving requires a certain amount of practice and acquired skill to insure a clean-cut result.

Gravers, like the one shown in Figure 15, can be obtained in various forms and widths of cutting point and are held with the rounded wood handle in the palm of the hand and the cutting edge firmly guided with the thumb and fingers. The tool must be kept very sharp and held at an angle that insures best cutting results. Slight, but uniform, pressure must be exerted and it is a very good plan to practice on a scrap piece of copper, until one becomes accustomed to cutting straight and curved lines. A pleasing result is often obtained by giving the tool a slight twisting motion while applying the pressure.

Often it is necessary to hold the work to be engraved in a firm manner so that both hands are free. To do this the metal is placed on a pitch pan or bowl, like the one shown with the graver in Figure 15.

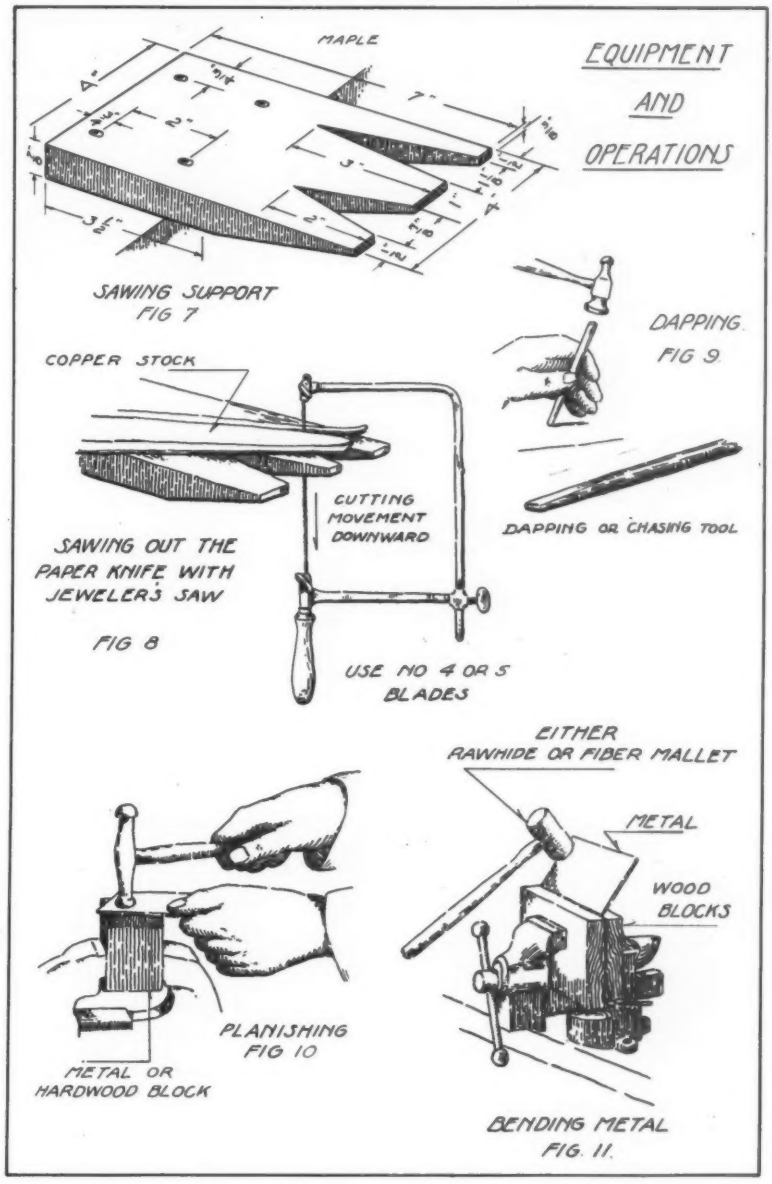
The metal to be chased or engraved, should be rubbed on the back with oil before it is attached. It will then stick to the pitch better and come away cleaner. It should be slightly heated and placed face upward on the pitch. It is then ready to be chased or engraved.

In chasing a design, it is outlined with metal punches and a chasing or dapping hammer. See Figure 9. The punches come in various sizes and shapes and may be made of ¼-inch-square tool steel, cut about four inches long and filed to a taper. Various widths of cutting edge may be made for different operations.

The pitch may be easily made in the proportions of one pound of pitch, two pounds of whiting, and one ounce of tallow. The pitch may be purchased from a shoemaker's supply house. Melt the pitch slowly, add the tallow, stir in the whiting, and pour into the pan.

Repoussè Work

Sometimes it is desired to dome the contour of the design, as in leaves and petals of flowers. This is done by placing the work face down on the pitch and using a tool similar to the one shown in Figure 17. These come with the ball ends varying in sizes, starting with less than ⅛ in. in diameter. They are moved over the work, hammering at the same time, until the desired form is obtained.



Coloring Metal

Besides the method previously described under *finishing*, metals may also be colored by the use of chemicals.

To make brass or copper *green*, prepare the following solution: Dissolve 16 grains each of copper nitrate, ammonium chloride, and calcium chloride in 3 oz. of water.

Blue-green: Make a solution at 180 deg. F. of ¼ oz. sodium thiosulphate, 2 oz. iron pernitrate, and 1 qt. water.

Verdigris green, for copper: In 1 qt. water, dissolve 1 oz. sal ammoniac, ¾ oz. common salt. Articles should be immersed in this for one hour.

Brown, for copper and brass: Dissolve ½ oz. ammonium sulphide in 1 qt. of water.

Etching

Etching is a fascinating and artistic method of enriching and decorating art

metal projects. All that is required in the way of equipment is a small can of asphaltum paint, two or three small water color brushes of various sizes, and a glass tray similar to those used in photography.

The asphaltum paint may be thinned with turpentine if too thick. All of the design upon which the acid is not to act is painted very carefully with the asphaltum paint, taking care to cover all parts thoroughly and leave clean-cut edges about the design to be etched.

The design is applied by first roughing the metal slightly with steel wool or fine emery cloth, and placing a piece of carbon paper between the design and the metal, and outlining the design with a hard pencil.

The asphaltum paint should dry for several hours until it does not feel sticky.

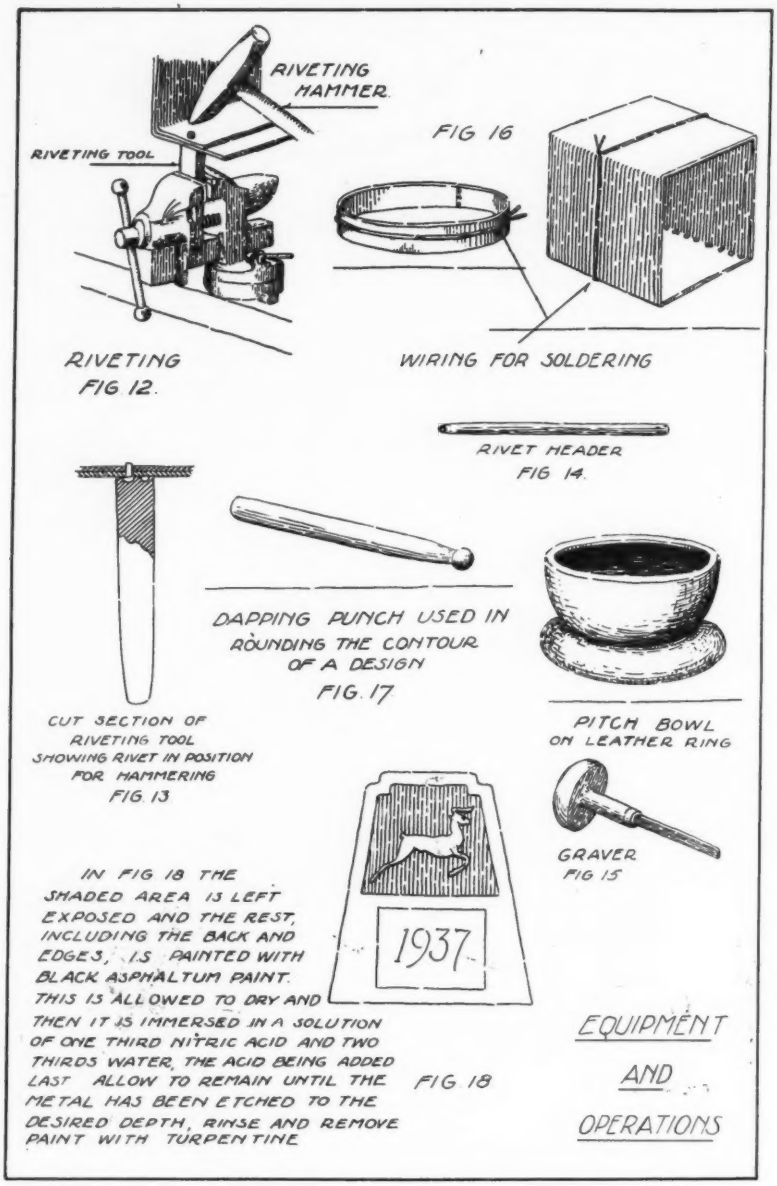
The acid solution is next prepared in a shallow glass or stoneware dish in the proportion of one-third nitric acid and two-thirds water, being sure to pour in the acid last. If after five or ten minutes the solution should bubble rather actively and throw off heavy greenish-yellow fumes, a little water should be added, for if the acid acts too rapidly it will undercut the paint outline leaving an irregular edge which is not satisfactory. Take care not to get the acid on the clothing. If this should happen, strong ammonia will help neutralize it and prevent its eating into the material. The duration of the etching process will vary from thirty minutes to four hours, depending on the strength of the solution. It should not be hurried. There are many good etching solutions, or so-called mordants, on the market ready prepared.

Lift the metal carefully occasionally from the solution to see now the etching is progressing. As soon as the required depth has been obtained, remove the piece, rinse it off thoroughly under running water, and remove the asphaltum by means of a rag soaked in turpentine or kerosene. Finally clean with soap and water and dry.

Figure 18 shows how the design of the deer may be etched. The darkened area shows the recessed background etched in by the acid solution. In this case the deer would be left plain and the face of the stand itself planished or hammered with the ball-peen hammer.

Various and interesting treatments of scenes from nature showing mountains, a lake, and a foreground may be etched to various depths, etching the furthest skyline first with all other parts blocked out with the asphaltum paint.

After this is completed the middle distance and previous background are exposed to the acid, making three distinct depths etched into the metal giving the hint of depth and perspective.


RIVETING HAMMER
RIVETING TOOL
FIG 16
RIVETING FIG 12.
WIRING FOR SOLDERING
RIVET HEADER FIG 14.
DAPPING PUNCH USED IN ROUNDING THE CONTOUR OF A DESIGN FIG. 17
CUT SECTION OF RIVETING TOOL SHOWING RIVET IN POSITION FOR HAMMERING FIG. 13
PITCH BOWL ON LEATHER RING
GRAVER FIG 15
IN FIG 18 THE SHADED AREA IS LEFT EXPOSED AND THE REST, INCLUDING THE BACK AND EDGES, IS PAINTED WITH BLACK ASPHALTUM PAINT. THIS IS ALLOWED TO DRY AND THEN IT IS IMMERSED IN A SOLUTION OF ONE THIRD NITRIC ACID AND TWO THIRDS WATER, THE ACID BEING ADDED LAST ALLOW TO REMAIN UNTIL THE METAL HAS BEEN ETCHED TO THE DESIRED DEPTH, RINSE AND REMOVE PAINT WITH TURPENTINE
1937
FIG 18
EQUIPMENT AND OPERATIONS

Protecting Metal

Lacquer affords, by far, the best protection for metal, but it is rather difficult to use. First clean the work thoroughly and the lacquering should be done in a room free from drafts and dirt. Heat the lacquer slightly and apply rapidly in one direction only, covering the entire surface. Do not touch with the fingers. If it is necessary to remove the lacquer, boil in a strong solution of washing soda and water.

Wax is very good, especially on copper. Ordinary floor or furniture wax is applied with a soft cloth and then rubbed down hard with a piece of cheesecloth to a uniform polish.

This may be renewed by rubbing and if necessary a new coat of wax applied.

Paper Knife

First, decide upon the outline design of the knife itself, selecting one that fits the hand and is simple and well balanced. Draw carefully on a folded piece of paper 1¼ by 8 in., one half the design. See Figure 6. Cut out the completed design. Then cut out a piece of 16-gauge copper, a little larger all around than the paper template. Next, apply a thin layer of glue to the back of the paper, and attach it to the piece of metal. Allow the glue to dry for a few minutes, and then saw very close to the line with a jeweler's saw, using a No. 4 blade.

Technique of Metal Sawing

It is necessary to have some form of holder upon which to place the work while sawing. One made of maple similar to the one shown in Figures 7 and 8, is suitable and may be either clamped or screwed to a bench or old table. Insert the saw at the end away from the handle. Place frame against the bench, and by pressing on the handle with the body, insert the other end of the blade and tighten. This insures the blade being tight and firmly held in the frame.

The work is held with the left hand and the saw worked in a perfectly vertical position up and down with the right hand. The saw blade should be inserted in the frame with the teeth pointing downward, or toward the handle, and a very slight pressure used. In turning corners or following curves, the blade must remain vertical, but slowly turned to follow the new direction while the saw continues the up and down motion.

Bearing on hard or forcing the blade around a turn results in broken saw blades. With a little practice, one blade will last a long time.

Keep the fingers of the left hand as close to the saw as possible to prevent the work jumping.

After the sawing is completed, the edges of the work should be filed with a fine file, rubbed with No. 0 emery cloth and finally finished with steel wool. The surface of the knife and design should be treated in a similar manner, removing all scars and leaving a smooth, pleasing finish.

Filing and Smoothing

The edges of the knife from the handle to the point should be filed to an even cutting edge, working from the upper surface of the knife only. These edges must be smoothed up with emery and steel wool and tried out on a folded piece of paper to see that the knife really cuts and does not tear. It is also a good plan, if the deer design is used, to round over all edges of the deer from the top surface to show the contour of the animal's body. The eye, under the jaw, and where the legs join the body should be incised with a dapping tool. The method of using this tool is shown in Figure 9. A very good dapping tool may be made from the tank end of an old file or even from a nail.

Use of Dapping Tool

Dapping tools come in various sizes varying from very fine to coarse. Some are slightly curved to follow around a curve more readily.

Hold the tool as indicated in Figure 8, with the forward end slightly tipped up. Strike light taps with the hammer and push the tool along as the hammering goes on. Do not hit hard, uneven blows but make haste slowly, keeping control of the tool at all times to insure a uniform and well-balanced line.

The dapping on this design is very simple and little difficulty should be experienced.

Solder the deer in position as has been described under soldering.

The various drawings are self-explanatory in suggesting the way of enlarging or transfering the design.

The handle above the blade should be planished or hammered with a ball-peen hammer. See Figure 10.

Paperweight

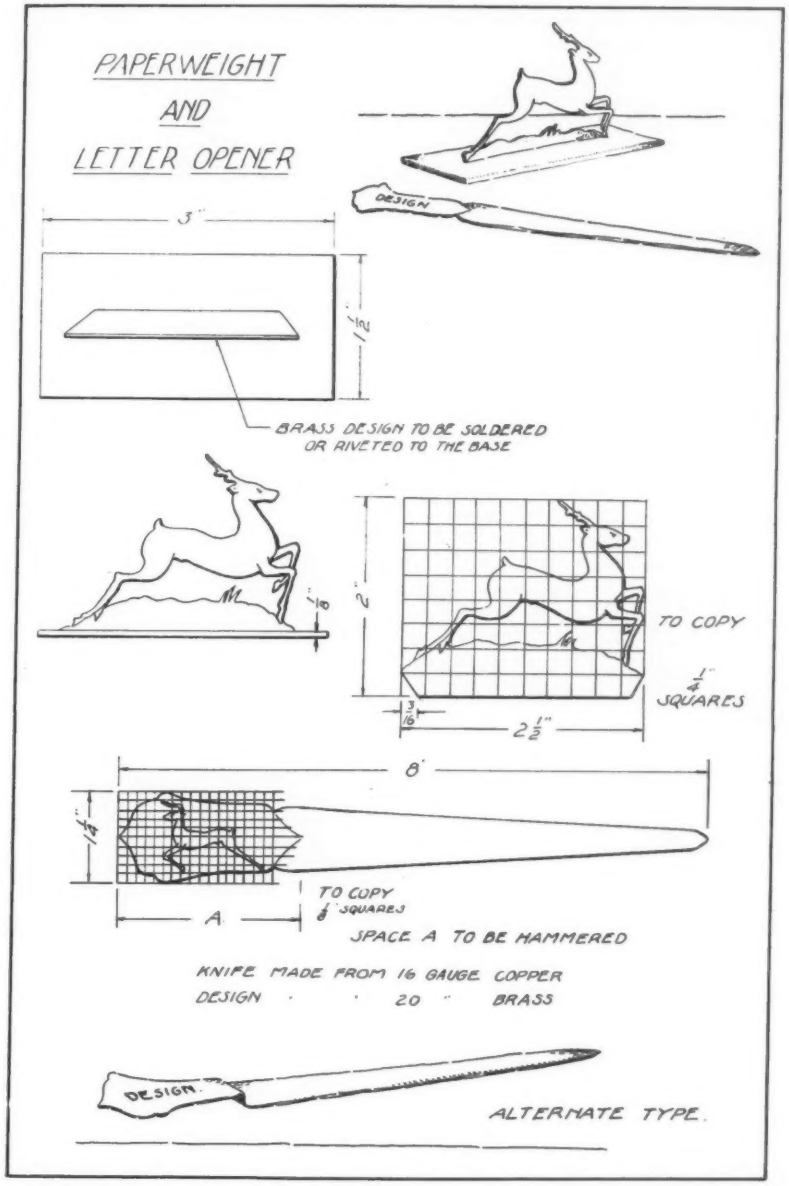
If the deer design is used, cut a piece of paper 2 by 2½ in. and divide into ¼-in. squares as shown. Draw the design by following the lines through the squares in the same places they are shown on Plate 1.

Glue the design on a piece of 18-gauge brass and saw out as previously explained in the *Technique of Sawing*. File, finish, and dap as described under *Filing and Sawing* and *Use of Dapping Tool*. Bend at right angles in vise at point shown on Plate 1. For method of bending see Figure 11.

For the base, cut a piece of copper ⅛ by 1½ by 3 in. Square this up, and file and planish top surface and edges, as indicated in Figure 10.

Attach by soldering. (Refer to *Soft Soldering*.) Glue a piece of felt to the base to avoid marring the desk top.

(To be continued)



Extracurricular Activities

F. N. Newton, Jr.

Senior High School,
Sharon, Pennsylvania

Giving the students an opportunity to sample leisure-time activities.

For some years, it has become increasingly evident that future workers will have more and more leisure time. In order that people may use this leisure profitably, it is evident to far-sighted schoolmen that some training during high-school years should be given to our youth which will help them acquire knowledge of useful hobbies or vocations that would prove profitable when practiced during their leisure.

In line with this, our local high school has been for some time trying an experiment that I believe will prove of interest to other schoolmen, particularly men engaged in industrial arts and vocational work. It is not that the old "readin', writin', and 'rithmetic" are giving way — it is simply that life's complexities insist that they are not enough, and education must keep step with the times. Our high school has an enrollment of approximately sixteen hundred students. Under the experiment, our students are offered trained guidance in useful and interesting side occupations along with routine studies. The main object is to open the many enjoyable hobbies and avocations which may be pursued in leisure time, and it has been found that the field is nearly unlimited.

In the beginning, a questionnaire was given to each student which listed a great number of activities, hobbies, and the like. The student was to mark the questionnaire with a first, second, and third choice and was then to turn it in to his or her homeroom teacher. These were all collected and sent to the office, and were tabulated. Where possible, each student was placed in a group which was his first choice. Only where groups became too large were the students placed in second-choice groups.

Once a week during the 45-minute activities period, all of these groups or clubs meet. Every student in school must belong to some group. It was possible during the first three weeks for a student to transfer from one group to another when he found that the group which he had selected did not exactly suit his fancy. All the groups elect their own officers and a program committee.

Each group is supervised by a member of the faculty who is in attendance at all meetings. In cases where the faculty supervisor is not conversant with the activities of the particular group, an outsider has been brought in who takes charge of the meeting. In checking up our city, we had no trouble in finding people who were glad to come in one period a week to teach our students in their particular vocation. In other cases, speakers come in periodically to talk to the groups.

There are 38 different groups established at present. This is a large number, but the experiment is very interesting. The clubs run for a complete semester and then there is a regrouping. Should a student desire to change his or her group, permission is given so that during the four years in high school, it is possible for a student to learn considerable about quite a number of activities.

During the present semester, the students may choose from the following list:

List of Subjects of Avocational Interest

Airplane models	Dramatics	Museum
Archery	Electricity	Music — novelty
Astronomy	Forestry	Nature study
Auto driving	Golf	Nursing
Aviation	Hiking	Photography
Book club	How to entertain	Radio
Boxing, wrestling	Hair dressing, beauty culture	Recreational leadership
Cartooning	Homemaking	Scrap book
Crafts	Interior decorating	Sewing, knitting
Dancing — beginning	Journalism	Shooting
Dancing — advanced	Magic	Stamps
Debating, public speaking	Marionette	What's what in dress and good manners for girls
Dietetics	Mechanics	

Safety Rules for the Printshop

E. Pieri

Public Schools,
Fort Bragg, California

A set of rules to insure the safe operation of printing machinery.

The following general safety rules apply to the operation of all machines and must be observed by students *at all times* while using printing machinery:

General Safety Rules for Printing Machinery

1. Machine must not be operated while instructor is out of room.
2. No adjustments should be made while machine is running.
3. Aprons should be securely fastened and extreme care taken so that they do not come in contact with moving parts of machines.
4. Power should always be shut off after machine is used.
5. Care must be taken to see that paper is placed right side up on machine. If in doubt, consult instructor.
6. Never operate any machine until you have been assigned to do so by instructor.
7. Talking to a student while he is operating a machine is forbidden.
8. Do not put type or other materials into your mouth.
9. Never make repairs or attempt to clean motors unless so ordered by the instructor.
10. Instructor's O.K. is absolutely necessary before any student operates a machine.

In addition to these general safety rules, the following special safety instructions must be observed by students when operating printing machinery:

Safety Instructions for Platen Presses

1. Never at any time attempt to take a sheet from the platen when it goes below the guides.
2. Do not take a sheet that has fallen between the feed board and platen or impression screws.

3. Do not attempt to run the machine by hand from the rear of the press.
4. Do not wash or oil machine while press is in motion.
5. Do not put rubbers on grippers while press is in motion.
6. If a sheet falls under the press, do not take it out until machine is stopped.

Safety Instructions for Cylinder Press

1. If the press must be run by hand, do not place hands on large pulley. Always turn it over by the flywheel.
2. Do not oil press while it is in motion.

Safety Instructions for Paper Cutter

1. Keep hand away from knife.
2. When cutting paper, place both hands on lever.
3. Never attempt to place one hand against the paper and pull the lever with the other hand.
4. The knife should never be taken out of the cutter by the student.

Safety Instructions for Miller Saw

1. The saw should never be used by any student who is not assigned to it.
2. The top guard must be kept down over the saw while machine is being operated.
3. Never place hands on line of the saw.
4. Students should never attempt to remove scraps close to the saw with their fingers.

Safety Instructions for Stitching Machines

1. Do not place fingers under the shoe.
2. Do not place hands on any movable part of machines while in operation.

Safety Instructions for Linotype

1. Keep hands away from moving parts of machine where there is any chance of getting pinched.
2. Never attempt to adjust mats in assembler until line carriage has returned to position.
3. Never allow any moisture to come in contact with molten metal.

Health Hazards

Lead Poisoning. Keep type from mouth. Avoid dry sweeping. Do not eat in the workroom. Wash hands before eating. Clean nails often. Do not chew or smoke while at work.

Cleaning Liquid. Provide proper ventilation. Do not splash liquid on hands or clothing.

Platen Press. Do not try to feed very small or odd-shaped sheets. Do not reach for falling sheets.

Paper Cutter. Work alone when cutting paper. Do not catch scraps as they come from the knife.

Tripping and Falling. Keep floors free of waste paper, etc.

Sleeves, Ties, Trousers, Smocks. Do not wear a long tie, loose smock, flapping sleeves or trousers. Roll sleeves and trousers.

Oiling Machine When in Operation. Do not wipe or oil machine while it is in operation.

Handling of Paper. Take care of paper cuts to avoid infection. Do not lift heavy paper loads.

Horseplay. Refrain from wrestling or other play around machinery.

Talking with Workmen Operating Machines. Do not talk to operators working at machines.

To Be Filled Out by the Student:

I have carefully read and fully understand all the foregoing safety rules regarding the operation of printing machinery.

I hereby promise to observe these rules at all times while enrolled as a student in the Printing Department of ..... High School.

Date .....

Signed .....

Sheet-Metal Gauges and Their Use

Lee M. Klinefelter

Norfolk, Virginia

Information that will please the teachers of metalwork who use wire and sheet metal.

Most teachers, when asked: Do you know how to buy or order sheet metal; do you know whether to order by weight, thickness, or gauge; if by gauge, do you know which gauge to use, have to answer "no" to the three questions. This is not strange, for the sheet-metal-gauge situation in this country is confusing, to say the least. There are in common use, a half dozen or more gauges, some of them logical and reasonable, others quite the reverse.

To clear up some of the confusion as to which gauge to use, Table 1 gives this information for the more common sheet metals, while in Table 2 the thickness of the more commonly used number gauges for sheet metal are compared. It should

SHEET METALS AND THEIR GAUGES

Metal or Alloys	Standards or Gauges						
	Wt. per Sq. Ft.	U.S. Std. Gauge	Amer. (B&S)	B'ham Stubbs	Galv. Gauge	Tin Pl. Gauge	Zinc Gauge
Aluminum			X				
Aluminum alloys			X				
Brass			X				
Bronze			X				
Condenser tubes				X			
Copper	X		X	X			
Galv. Iron					X		
German silver			X				
Hack-saw blades				X			
Iron (wrought)		X					
Lead	X						
Monel		X					
Nickel silver			X				
Seamless tubing				X			
Silver			X				
Steel		X					
Tin plate						X	
Zinc							X

Table 1

COMPARISON OF PRINCIPAL SHEET-METAL GAUGES

Gauge No.	Thickness in Inches					
	U. S. Iron	Standard Steel	American (B&S)	B'ham Stubbs	Galv. Gauge	Zinc Gauge
0000000	.500	.490				
000000	.469	.460	.580			
00000	.438	.429	.517	.500		
0000	.406	.398	.460	.454		
000	.375	.368	.410	.425		
00	.344	.337	.365	.380		
0	.312	.306	.325	.340		
1	.281	.276	.289	.300		.003
2	.266	.260	.258	.284		.004
3	.250	.245	.229	.259		.006
4	.234	.230	.204	.238		.008
5	.219	.215	.182	.220		.010
6	.203	.199	.162	.203		.012
7	.188	.184	.144	.180		.014
8	.172	.169	.128	.165	.173	.016
9	.156	.153	.114	.148	.157	.018
10	.141	.138	.102	.134	.142	.020
11	.125	.123	.0907	.120	.127	.024
12	.109	.107	.0808	.109	.111	.028
13	.0938	.0919	.0720	.095	.096	.032
14	.0781	.0766	.0641	.083	.080	.036
15	.0703	.0689	.0571	.072	.073	.040
16	.0625	.0613	.0508	.065	.065	.045
17	.0562	.0551	.0453	.058	.059	.050
18	.0500	.0480	.0403	.049	.052	.055
19	.0438	.0429	.0359	.042	.047	.060
20	.0375	.0368	.0320	.035	.041	.070
21	.0344	.0337	.0285	.032	.038	.080
22	.0312	.0316	.0254	.028	.036	.090
23	.0281	.0276	.0226	.025	.032	.100
24	.0250	.0245	.0201	.022	.029	.125
25	.0219	.0214	.0179	.020	.025	.250
26	.0188	.0184	.0159	.018	.022	.375
27	.0172	.0169	.0142	.016	.081	.500
28	.0156	.0153	.0126	.014	.019	1.000
29	.0141	.0138	.0113	.013	.018	
30	.0125	.0123	.0100	.012	.016	
31	.0109	.0107	.0089	.010	.015	
32	.0102	.0100	.0080	.009	.014	
33	.0094	.0092	.0071	.008	.013	
34	.0086	.0084	.0063	.007	.012	
35	.0078	.0077	.0056	.005		
36	.0070	.0069	.0050	.004		
37	.0066	.0065	.0045			
38	.0062	.0061	.0040			
39	.0059	.0057	.0035			
40	.0055	.0054	.0031			

Table 2

be noticed that the American (Brown and Sharp) and the Birmingham or Stubb's gauges are properly wire gauges, though widely used for sheet metal.

The "United States standard gauge for sheet and plate iron and steel" is the commonly used gauge for uncoated sheet and plate iron and steel. It was adopted by Congress, March 3, 1893, as a *weight* gauge, and the approximate thicknesses corresponding to the various weights were based on the weight of wrought iron, 480 pounds per cubic foot or 40 pounds per square foot per inch thick. Since then, soft steel and open-hearth iron weighing about 490 pounds per cubic foot, or 40.8 pounds per square foot per inch thick, have come into general use resulting in slightly smaller thicknesses for the same gauges. Table 3 gives the approximate thicknesses corresponding to the numbers and weights for iron and steel.

UNITED STATES STANDARD GAUGE FOR SHEET AND PLATE IRON AND STEEL

Gauge No.	Weight per Sq. Ft. Ounces	Pounds	Thickness in Inches Wrought Iron	Steel & Open Hearth Iron
0000000	320	20.00	.500	.490
000000	300	18.75	.469	.460
00000	280	17.50	.438	.429
0000	280	16.25	.406	.398
000	240	15.00	.375	.368
00	220	13.73	.344	.337
0	200	12.50	.312	.306
1	180	11.25	.2812	.2757
2	170	10.62	.2656	.2604
3	160	10.00	.2500	.2451
4	150	9.375	.2344	.2298
5	140	8.750	.2188	.2145
6	130	8.125	.2031	.1991
7	120	7.500	.1875	.1838
8	110	6.875	.1719	.1685
9	100	6.250	.1562	.1532
10	90	5.625	.1406	.1379
11	80	5.000	.1250	.1225
12	70	4.375	.1094	.1072
13	60	3.750	.0938	.0919
14	50	3.125	.0781	.0766
15	45	2.812	.0703	.0689
16	40	2.500	.0625	.0613
17	36	2.250	.0562	.0551
18	32	2.000	.0500	.0490
19	28	1.750	.0438	.0429
20	24	1.500	.0375	.0368
21	22	1.375	.0344	.0337
22	20	1.250	.0312	.0306
23	18	1.125	.0281	.0276
24	16	1.000	.0250	.0245
25	14	.8750	.0219	.0214
26	12	.7500	.0188	.0184
27	11	.6875	.0182	.0169
28	10	.6250	.0156	.0153
29	9	.5625	.0141	.0138
30	8	.5000	.0125	.0123
31	7	.4375	.0109	.0107
32	6½	.4062	.0102	.0100
33	6	.3750	.0094	.0092
34	5½	.3438	.0086	.0084
35	5	.3125	.0078	.0077
36	4½	.2812	.0070	.0069
37	4¼	.2656	.0066	.0065
38	4	.2500	.0062	.0061
39	3¾	.2344	.0059	.0057
40	3½	.2188	.0055	.0054
41	3¼	.2109	.0053	.0052
42	3¼	.2031	.0051	.0050
43	3¼	.1953	.0049	.0049
44	3	.1875	.0047	.0046

Table 3

Table 4 gives the common lengths and widths of black and galvanized iron and steel sheets, with the number of square feet per sheet. By combining the data from Tables 3 and 4, the weight of any size black sheet in any gauge can be found.

The galvanized-sheet gauge is based on the United States standard gauge with 2½ ounces per square foot added for the weight of zinc. This adds approximately .004 inch to the thickness of steel plates. Table 5 gives the approximate thickness and weight of galvanized-steel plates in accordance with this data. When combined with Table 4, the weight of galvanized sheets of any gauge can be found.

Both black and galvanized sheets are ordinarily bundled in bundles of from 130 to 195 pounds. Sheets weighing more than 98 pounds are not commonly bundled but are handled singly.

SQUARE FEET IN STANDARD-SIZE BLACK AND GALVANIZED IRON SHEETS

Width in Inches	Length in Inches: 72	84	96	101	108	120
	Area in Square Feet					
24	12	14	16	16.8	18	20
26	13	15.2	17.3	18.3	19.5	21.7
28	14	16.3	18.7	19.7	21	23.4
30	15	17.5	20	21	22.5	25
36	18	21	24	25.2	27	30

Table 4

GALVANIZED SHEET GAUGE

Gauge No.	Approx. Thickness	Weight per Sq. Ft. Ounces	Pounds
8	.173	112.5	7.031
9	.157	102.5	6.406
10	.142	92.5	5.781
11	.127	82.5	5.156
12	.111	72.5	4.531
13	.096	62.5	3.906
14	.080	52.5	3.281
15	.073	47.5	2.969
16	.065	42.5	2.656
17	.059	38.5	2.406
18	.052	34.5	2.156
19	.047	30.5	1.906
20	.041	26.5	1.656
21	.038	24.5	1.531
22	.036	22.5	1.406
23	.032	20.5	1.281
24	.029	18.5	1.156
25	.025	16.5	1.031
26	.022	14.5	.906
27	.021	13.5	.844
28	.019	12.5	.781
29	.018	11.5	.719
30	.016	10.5	.656
31	.015	9.5	.594
32	.014	9.0	.562
33	.013	8.5	.531
34	.012	8.0	.500

Table 5

Our tin plate gauge was inherited from the old British tin industry. It is based on the weight of a "base box" of 112 sheets, each 14 by 20 inches, equal to 31,360 square inches or 217.78 square feet.

The terms *cokes* and *charcoals* formerly referred to the type of sheet iron under the tin coating, but now refer to the weight or quality of the tin coating, the lighter ones being "cokes" and the heavier coatings "charcoals." The letters A to AAAAA are sometimes used to indicate

TIN-PLATE GAUGE

Gauge or Symbol	Lb. per base box	Weight per Sq. Ft. Ounces	Pounds	Approximate Thickness
55-lb.	55	4.04	.253	.0062
60-lb.	60	4.41	.276	.0068
65-lb.	65	4.78	.298	.0073
70-lb.	70	5.14	.321	.0079
75-lb.	75	5.51	.344	.0084
80-lb.	80	5.88	.367	.0090
85-lb.	85	6.24	.390	.0096
90-lb	90	6.61	.413	.0101
95-lb.	95	6.98	.436	.0107
IXL	100	7.35	.459	.0113
IC	107	7.86	.491	.0120
108-lb.	108	7.93	.496	.0122
110-lb.	110	8.08	.505	.0124
112-lb.	112	8.23	.514	.0126
118-lb.	118	8.67	.542	.0133
123-lb.	123	9.04	.565	.0138
125-lb.	125	9.18	.574	.0141
IXL	128	9.40	.588	.0144
IX	135	9.92	.620	.0152
DC	139	10.21	.638	.0156
143-lb.	143	10.51	.657	.0161
2XL	148	10.87	.680	.0167
2X	155	11.39	.712	.0174
163-lb.	163	11.98	.748	.0183
3XL	168	12.34	.771	.0189
3X	175	12.86	.804	.0197
DX	180	13.22	.827	.0203
4XL	188	13.81	.863	.0212
4X	195	14.33	.895	.0219
5XL	208	15.28	.955	.0234
D2X	210	15.43	.964	.0236
5X	215	15.80	.987	.0242
6XL	228	16.75	1.047	.0257
6X	235	17.27	1.079	.0264
D3X	240	17.63	1.102	.0270
7XL	248	18.22	1.139	.0279
7X	255	18.73	1.171	.0287
8XL	268	19.69	1.231	.0302
D4X	270	19.84	1.240	.0304
8X	275	20.20	1.263	.0309

Table 6

THICKNESS AND NEAREST GAUGE NUMBER OF COPPER SHEETS ROLLED TO WEIGHT

Weight per Sq. Ft. Ounces	Pounds	Thickness Inches	Nearest Gauge Number B'ham or Stubb's	American (B.& S.)	Nearest Fraction
2	.125	.0027		41	
4	.250	.0054	35	35	
6	.375	.0081	33	32	
7	.438	.0093	32	31	
8	.500	.0108	31	29	
9	.563	.0120	30	28	
10	.625	.0135	29	28	
11	.688	.0146	28	27	
12	.750	.0162	27	26	1/64
13	.813	.0173	26	25	
14	.875	.0189	26	25	
15	.938	.0202	25	24	
16	1.000	.0216	24	23	
18	1.125	.0243	23	22	
20	1.25	.0270	22	21	
24	1.50	.0324	21	20	1/32
28	1.75	.0378	20	19	
32	2.00	.0432	19	17	
36	2.25	.0486	18	16	3/64
40	2.50	.0540	17	15	
44	2.75	.0594	17	15	
48	3.0	.0648	16	14	1/16
56	3.5	.0756	15	13	5/64
64	4.0	.0864	14	11	
72	4.5	.0972	13	10	3/32
80	5.0	.1080	12	10	7/64
	5.5	.1188	11	9	
	6.0	.1296	10	8	1/8
	6.5	.1404	10	7	9/64
	7.0	.1512	9	7	5/32
	7.5	.1620	8	6	
	8.0	.1728	8	5	11/64
	8.5	.1836	7	5	3/16
	9.0	.1944	6	4	
	9.5	.2052	6	4	13/64
	10	.2160	5	4	7/32
	11	.2376	4	3	15/64
	12	.2592	3	2	1/4
	13	.2808	2	1	9/32
	14	.3024	1	1	19/64
	15	.3240	0	0	21/64
	16	.3456	00	00	11/32
	18	.3888	00	000	25/64
	20	.4320	000	000	7/16

Table 7

THICKNESS AND WEIGHT OF COPPER SHEETS ROLLED TO GAUGE

Gauge Number	American (B. & S.) Thickness Inches	Weight Pounds	B'ham or Stubb's Thickness Inches	Weight Pounds
0000	.4600	21.27	.454	21.02
000	.4096	18.94	.425	19.68
00	.3648	16.87	.380	17.59
0	.3249	15.03	.340	15.74
1	.2893	13.38	.300	13.89
2	.2576	11.91	.284	13.15
3	.2294	10.61	.259	11.99
4	.2043	9.45	.238	11.02
5	.1819	8.41	.220	10.19
6	.1620	7.49	.203	9.40
7	.1443	6.67	.180	8.33
8	.1285	5.94	.165	7.64
9	.1144	5.29	.148	6.85
10	.1019	4.71	.134	6.20
11	.0907	4.20	.120	5.56
12	.0808	3.74	.109	5.05
13	.0720	3.33	.095	4.40
14	.0641	2.97	.083	3.84
15	.0571	2.64	.072	3.33
16	.0508	2.35	.065	3.01
17	.0453	2.10	.058	2.69
18	.0403	1.86	.049	2.27
19	.0359	1.66	.042	1.95
20	.0320	1.48	.035	1.62
21	.0285	1.32	.032	1.48
22	.0253	1.17	.028	1.30
23	.0226	1.05	.025	1.16
24	.0201	.930	.022	1.02
25	.0179	.828	.020	.926
26	.0159	.735	.018	.833
27	.0142	.657	.016	.741
28	.0126	.583	.014	.648
29	.0113	.523	.013	.602
30	.0100	.463	.012	.556
31	.0089	.413	.010	.463
32	.0080	.369	.009	.417
33	.0071	.327	.008	.370
34	.0063	.291	.007	.324
35	.0056	.260	.005	.232
36	.0050	.232	.004	.185
37	.0045	.206		
38	.0040	.184		
39	.0035	.163		
40	.0031	.145		

Table 8

NONFERROUS METALS AND ALLOYS ROLLED TO GAUGE (B. & S.)						
American (B.& S.) Gauge Number	Thickness in Inches	Pounds per Square Foot				
		Brass Manganese-Bronze	Nickel-silver German-silver	Silicon-bronze Phosphor-Bronze	Aluminum	Duralumin
0000	.4600	20.3	20.9	21.2	6.48	6.68
000	.4096	18.1	18.6	18.9	5.77	5.95
00	.3648	16.1	16.6	16.9	5.14	5.29
0	.3249	14.3	14.8	15.0	4.58	4.72
1	.2893	12.8	13.2	13.5	4.07	4.20
2	.2576	11.4	11.7	11.9	3.63	3.74
3	.2294	10.1	10.4	10.6	3.24	3.33
4	.2043	9.00	9.30	9.63	2.88	2.96
5	.1819	8.02	8.28	8.40	2.57	2.64
6	.1620	7.14	7.37	7.47	2.28	2.35
7	.1443	6.36	6.57	6.67	2.02	2.09
8	.1285	5.66	5.85	5.93	1.81	1.87
9	.1144	5.04	5.21	5.27	1.61	1.66
10	.1019	4.49	4.64	4.70	1.44	1.48
11	.0907	4.00	4.13	4.18	1.28	1.32
12	.0808	3.56	3.68	3.72	1.14	1.17
13	.0720	3.17	3.28	3.32	1.015	1.045
14	.0641	2.82	2.91	2.96	.903	.930
15	.0571	2.52	2.60	2.63	.805	.829
16	.0508	2.24	2.31	2.34	.715	.737
17	.0453	1.99	2.06	2.08	.639	.657
18	.0403	1.78	1.83	1.86	.566	.585
19	.0359	1.58	1.63	1.65	.505	.521
20	.0320	1.41	1.46	1.47	.451	.464
21	.0285	1.25	1.30	1.31	.401	.414
22	.0254	1.12	1.15	1.17	.357	.367
23	.0226	.996	1.03	1.04	.318	.328
24	.0201	.886	.915	.924	.283	.292
25	.0179	.789	.815	.826	.252	.260
26	.0159	.702	.724	.734	.224	.231
27	.0142	.626	.646	.655	.200	.206
28	.0126	.557	.574	.581	.177	.183
29	.0113	.496	.514	.521	.159	.164
30	.0100	.442	.455	.462	.141	.145
31	.0089	.393	.406	.412	.126	.130
32	.0080	.350	.362	.370	.112	.115
33	.0071	.312	.322	.328	.100	.103
34	.0063	.278	.287	.291	.0890	.0914
35	.0056	.247	.255	.259	.0791	.0814
36	.0050	.220	.228	.231	.0705	.0726
37	.0045	.196	.203	.207	.0628	.0646
38	.0040	.175	.181	.185	.0560	.0576
39	.0035	.156	.161	.162	.0498	.0512
40	.0031	.139	.143	.144	.0443	.0456

Table 9

MONEL-METAL SHEETS			
Gauge No.	Thickness in Inches	Weight per Sq. Ft.	
		Ounces	Pounds
2	.266	194½	12.21
3	.250	183	11.49
4	.234	171½	10.77
5	.219	160½	10.06
6	.203	149¼	9.34
7	.188	137½	8.62
8	.172	126	7.90
9	.156	114½	7.18
10	.141	103	6.47
11	.125	91½	5.75
12	.109	80¼	5.03
13	.094	68¾	4.31
14	.078	57¼	3.59
15	.070	51½	3.23
16	.063	45¾	2.87
17	.056	41	2.59
18	.050	36¾	2.30
19	.044	32	2.01
20	.038	27½	1.72
21	.034	25	1.58
22	.031	22¾	1.44
23	.028	20½	1.29
24	.025	18¼	1.15
25	.022	16	1.01
26	.019	13¾	.86

Table 10

AMERICAN ZINC GAUGE			
Gauge No.	Thickness in Inches	Weight per Sq. Ft.	
		Ounces	Pounds
1	.002	1¼	.075
2	.004	2½	.150
3	.006	3¾	.224
4	.008	4¾	.299
5	.010	6	.374
6	.012	7¼	.449
7	.014	8½	.523
8	.016	9¾	.598
9	.018	10¾	.673
10	.020	12	.748
11	.024	14½	.897
12	.028	16¾	1.05
13	.032	19¼	1.20
14	.036	21¼	1.35
15	.040	24	1.50
16	.045	27	1.68
17	.050	30	1.87
18	.055	33	2.06
19	.060	36	2.24
20	.070	42	2.62
21	.080	48	2.99
22	.090	54	3.36
23	.100	60	3.74
24	.125	74¾	4.67
25	.250	149½	9.35
26	.375		14.02
27	.500		18.69
28	1.000		37.38

Table 11

Lead Sheets Rolled to Weight			
Wt.per sq.ft. in lb.	Approximate Thickness		Decimal Inch
	Fraction Inch		
1	1/64		.017
1½	3/128		.025
2	1/32		.034
2½	5/128		.042
3	3/64		.051
3½	7/128		.059
4	1/16		.068
5	5/64		.085
6	3/32		.102
8	1/8		.136
10	5/32		.170
12	3/16		.203
14	7/32		.237
15	1/4		.254
16	9/32		.271
20	11/32		.339
24	13/32		.407
30	1/2		.509
40	11/16		.678
60	1 1/64		1.017

Table 12

the increasing thickness of the coating.

Taggers tin is a name applied to any tin plates of 65 pounds or less per base box.

Terneplate, commonly used for roofing, has a coating of approximately 75 per cent lead and 25 per cent tin. It is not commonly made lighter than IC weight, or 107 pounds per base box. Both tin plate and terneplate are sold in rolls for roofing and other purposes, but are more commonly sold in boxes of 112 sheets of various sizes. Table 6 gives the most important data for tin plates.

When we come to sheet copper, the situation is rather complicated, for copper is rolled to three different standards. These are the Birmingham or Stubb's gauge, the American (B. & S.) gauge, and "weight per square foot." Because of this condition, the safest way to order is to specify thickness in mills (thousandths of an inch) along with the gauge or weight.

Table 7 gives the thickness of copper sheets rolled to weight, as well as the nearest gauge number, while in Table 8 the weights of copper sheets rolled to gauge are given.

In Table 9, the weights per square foot of a number of nonferrous metals and alloys are given. To save space, these have been combined. Since these alloys vary somewhat in composition, their weights can be given only approximately. All of these alloys are commonly rolled and sold to the American gauge, but to be on the safe side specify thickness when ordering.

Monel metal, a very popular alloy of about 67 per cent nickel, 28 per cent copper, and 5 per cent other metals, has a most peculiar gauge. Since it has been used largely to replace iron and steel plates, it is commonly rolled to thicknesses corresponding to the wrought-iron thicknesses of the United States standard gauge. The result is somewhat confusing, since this is strictly a weight gauge for wrought iron, and the thicknesses are only approximate values derived from the weights. Table 10 gives the gauge numbers and corresponding thicknesses and weights.

Sheet zinc has a double distinction, for it not only has a gauge all its own, but it also has one of the very few in which increasing gauge numbers go with increasing thickness. Its thicknesses and corresponding weights are given in Table 11.

Sheet lead is commonly rolled to weights of from 1 to 60 pounds per square foot. Table 12 lists the standard weights, their decimal thicknesses based on a weight of 59 pounds per square foot per inch thick, and their nominal fractional thicknesses.

Casting in the School Shop—IX

N. A. McMillan

Elmira, New York

Through the courtesy of the Aluminum Company of America, much of the information on aluminum has been obtained.

Aluminum can be cast with great satisfaction in the school shop. When cleaned and polished it has a very good effect for ornamental fixtures for home use, such as candlesticks, lamps, lamp bases, napkin rings, ash trays, etc. Under ordinary conditions aluminum does not oxidize readily, therefore keeping its luster for some time.

New aluminum ingots can be purchased for about 25 cents per pound. Scrap from old cars can be used to advantage, making sure to take out bearings or other metals before melting.

Molding Sand. In the selection of molding sand for aluminum alloy castings, its texture or mechanical composition is more important than its chemical composition. A good molding sand should be neither "close" nor "open." If it is too fine it will not be free venting and will therefore prevent the air, steam, and gases

For previous articles in this series, see January and September, 1934; May and October, 1935; April, September, and December, 1936, and March, 1937, issues of this magazine.

from escaping. On the other hand it should not be too coarse or it will fail to give a smooth and clean surface. No. 1 Albany sand is satisfactory.

Core Sand. Cores for aluminum casting should be made soft as is consistent with safe handling. Because of the "hot short" condition of aluminum alloys at high temperature, cores should give away to the contraction of the cooling metal. They should be hard enough to be handled at ordinary temperatures, but should soften and crush when subjected to the heat of the molten metal. A good core sand consists of a mixture of silica sand and sometimes molding sand held together by a binder.

Sand Casting Alloys. The Aluminum Company of America markets many different casting aluminum alloys. These are designated by numbers. The most common aluminum alloy is their No. 12, which is composed of about 92 per cent aluminum and 3 per cent copper.

The tensile strength of this alloy should be above 18,000 pounds per square inch, with 1.5 per cent elongation in 2 inches. Increasing the copper from 8 per cent to 12 or 14 per cent, increases the strength to some extent. Piston and other machine parts are made of this higher copper alloy. Alloy No. 12 is used for about 95 per cent of the aluminum castings made in the United States.

Melting and Pouring. Aluminum can be melted in ordinary plumbago crucibles without absorbing an appreciable amount of silicon from them. Cast-iron melting pots, however, are more generally used for melting purposes, and prove satisfactory, provided care is taken to prevent excessive iron pickup during the operation.

An important consideration in the production of good aluminum-alloy castings is the temperature of melting and pouring. The metal should be poured at the lowest possible temperature at which there is sufficient fluidity to fill the mold, and to allow air bubbles, gas, and dross to escape from the metal before it solidifies. At the same time, the melting and holding temperatures should be no higher than necessary to compensate for the natural drop in temperature between melting furnace and mold. In the ideal operation of a melting room, the metal is gradually brought to temperature and poured with a minimum of holding time. Pouring temperature is from 1200 to 1400 degrees F. depending on the cross section of metal. For thin castings a higher temperature is required than for a thick casting. Soaking of molten metal for any considerable length of time at high temperature may result in the absorption of furnace gases and a tendency for large grain size, shrinkage, and porosity in casting. Oxidation of aluminum, usually excessive at high temperatures, can also be maintained at a minimum by holding at a low temperature and avoiding unnecessary agitation of the molten metal. Oxides of aluminum formed in this manner are only partially removed by skimming and are often trapped in the castings. in the melting furnace may be overcome to some extent by carefully adding a sufficient quantity of solid alloy to cool the metal.

The pouring temperature of casting work depends almost entirely upon the thickness and the size of the casting and to a much less degree upon the composition of the alloy. The best pouring temperature for any one casting is generally determined by trial. Pouring the metal at too low a temperature may cause cold shuts, misruns, blow holes, and lack of sharpness in the detail of the casting. On the other hand, a high pouring temperature will result in low tensile strength, coarse-grained and porous structure, rough surface, shrinkage, and cracks.

Testing and Tests

Junior-High-School Woodworking Test

H. L. Stiles

High School,
Nogales, Arizona

This is form A of this test. Form B will appear at a later date.

Student's name.....
Grade.....
Age.....
Period.....
Date.....

Scores:
Part I: R-½W:.....
Part II: No. right:.....
Part III: No. right:.....
Total score:.....

Part I — True-False Woodworking Test

INSTRUCTIONS: Time: 20 minutes

1. This test contains 50 true-false statements..
2. Read each statement carefully.
3. If you think the statement is true put a plus (+) at the end of the statement.
4. If you think the statement is false, put a zero (0) in the parentheses at the end of the statement.
5. Study the samples carefully before beginning actual work.
6. Do not guess.

SAMPLE:

1. A hammer is used to drive nails. (true) (+)
2. Walnut is a soft wood. (false) (0)

TEST STATEMENTS:

1. Shellac sets more rapidly than varnish. ( )+*
2. A coping saw is used to cut out curved lines in thin wood. ( )+
3. The back saw is strengthened by a heavy steel back piece. ( )+
4. Plans originally were partly made of wood. ( )+
5. The saw kerf should be made on the waste side of the line. ( )+
6. The oftener glue is heated, the stronger it becomes. ( )0
7. Auger bits are measured by sixteenths of an inch. ( )+
8. Nails are sold by the gross. ( )0
9. The easiest stain to apply is water stain. ( )0
10. Lumber is sold by the square foot. ( )0
11. Gasoline is commonly used for cleaning shellac brushes. ( )0
12. A board foot is 12 inches thick, 12 inches wide, and 12 inches long. ( )0
13. The teeth of the coping saw point toward the handle. ( )+
14. The ball-peen hammer is the most commonly used tool for driving nails. ( )0
15. A piece of wood 1 by 8 in. by 12 ft. contains 12 board feet. ( )0
16. Several thin coats of shellac will produce a much better finish than one or two thick coats. ( )+
17. Oil stains penetrate the wood deeper than water stains. ( )0
18. The hand drill is used for turning and holding round-shank drill bits. ( )+
19. The woodworker's chisel is sharpened on both sides. ( )0
20. For general work the plane iron cap should be about ¼ in. from the cutting edge of the blade. ( )0
21. The marking gauge is never used across the grain. ( )+
22. The marking gauge is used to mark lines

*The key letter or word appears at the right of each test question.

parallel to the side of the stock. ( )+

23. The height of an object may be found by looking at the top view of a drawing. ( )0

24. The end of a board is usually squared before the edge. ( )0

25. The knife is used when laying out a joint. ( )+

26. The miter joint is used for putting together picture frames. ( )+

27. No. 0 sandpaper is coarser than No. 1 sandpaper. ( )0

28. Oily waste rags should not be put in wooden containers. ( )+

29. A bill of material should include a complete list of everything needed to complete the project. ( )+

30. A properly glued joint is stronger than the natural wood. ( )+

31. Animal glue is manufactured from the refuse parts of animals. ( )+

32. Joints should be sandpapered so that they will fit together easier. ( )0

33. Sandpaper should not be used across the grain. ( )+

34. The brace is used for holding square-shank twist drills while boring holes. ( )+

35. The firmer gouge is used for cutting grooves and hollowing out surfaces. ( )+

36. Saw teeth are said to have "pitch" when the teeth are bent alternately from side to side. ( )0

37. The try square is used for laying out lines across the grain at right angles to an edge. ( )+

38. Quarter-sawed lumber warps more than plain sawed. ( )0

39. Kiln-dried lumber contains more moisture than air-dried lumber. ( )0

40. Center lines are used for locating the centers of holes in a drawing. ( )+

41. The front view of a circle is represented by a straight line. ( )+

42. The countersink is used for making conical shaped holes for roundhead screws. ( )0

43. After paste filler has become dull it should be rubbed off in the direction of the grain. ( )0

44. The sizes of wood drill bits vary by sixteenths of an inch. ( )0

45. Knots are formed on trees by the growth of branches. ( )+

46. Heartwood as a rule shrinks more than sapwood. ( )0

47. Dovetail joints are frequently used in drawer construction. ( )+

48. White lead is used for thinning paint. ( )0

49. Heartwood absorbs more stain than sapwood. ( )0

50. The thick part of the annual rings is formed during the rapid growth of the tree in the spring. ( )0

Score: R-½W:.....

Part II — Simple Recall Woodworking Test

INSTRUCTIONS: Time: 15 minutes

1. This part contains 25 incomplete statements.
2. Read the statement carefully.
3. Decide which word would make the statement complete.
4. Write the word in the parentheses at the end of the statement.
5. Study the sample carefully before beginning actual work.

SAMPLE:

1. The hammer is used to drive (*nails*)

TEST STATEMENTS:

1. The age of a tree can be determined by the annual (.....) *rings*
2. Large wooden hammers are called (.....) *mallets*
3. In early days nails were made by (.....) *hand*
4. The term "penny" in woodworking refers to the size of (.....) *nails*
5. Lumber that has not been surfaced is sold as (.....) *rough*
6. The teeth of a crosscut saw are sharpened to a (.....) *point*
7. The length of a board is always measured along the (.....) *grain*
8. When driving nails hold the hammer handle near the (.....) *end*
9. The size of the hole an auger bit will bore is stamped on the (.....) *shank*
10. Glue is spread with a (.....) *brush*
11. The size of a saw is designated by the number of points to the (.....) *inch*
12. A large square which is used by carpenters for rough work is called the (.....) *framing square*
13. The best paste wood fillers are made by mixing ground rock, Japan, turpentine, and (.....) *linseed oil*
14. When accurate measuring is necessary the rule should be stood on its (.....) *edge*
15. Drill bits for use in hand drills have round (.....) *shanks*
16. When painting, all knots and pitchy places should be sealed with (.....) *shellac*
17. Small round wooden pins used in joining boards are called (.....) *dowels*
18. Cracks in the end of sawed-off lumber are called (.....) *checks*
19. Drawing boards are usually made of (.....) *basswood*
20. The coloring material in paints is referred to as (.....) *pigment*
21. Water stain tends to raise the (.....) *grain*
22. When ordering screws, it is necessary to give the diameter of the shank and the (.....) *length*
23. When large objects are drawn on paper they must be reduced in size, which is called drawing to (.....) *scale*
24. The chemical change which causes varnish to dry is called (.....) *oxidation*
25. Lacquer has come rapidly into use because it dries (.....) *quickly*

Score for Part II is number right:.....

Part III — Woodworking Completion Test

INSTRUCTIONS:

1. Certain words have been left out of the sentences below.
2. Underlined spaces show where the words are left out.
3. You are to write, on the underlined spaces, the words which have been left out.
4. Study the sample carefully before beginning actual work.

SAMPLE:

1. Walnut is classed as a ..*hard*.. wood.

TEST STATEMENTS:

1. In a working drawing the front view is placed to the left of the ..... view and below the top view. *end*
2. A board foot of lumber contains ..... square inches. *144*
3. S2S on a bill of material means that the board should be ..... on 2 sides. *surfaced*
4. Zigzag rules are usually ..... feet in length. *six*
5. The T bevel is used for laying out lines other than those at ..... angles to an edge. *right*
6. The jointer plane is about ..... inches long. *22*
7. When the plane iron become ..... it needs to be ground. *dull or nicked*
8. The plane should be laid on its ..... when not in use. *side*
9. The size of a saw is designated by the number of ..... to the inch. *points*
10. To prevent the saw from binding ..... is given to the teeth. *set*
11. The size of auger bits vary by ..... of an inch. *sixteenths*
12. Hand scrapers are sharpened with a ..... for ordinary work. *file*
13. Always sand with the ..... when possible. *grain*
14. Finishing nails are smaller in ..... than common nails. *diameter*
15. When pulling large nails a block should be placed under the ..... of the hammer. *head*
16. Dadoes are cut ..... the grain. *across*
17. Animal glue must be ..... in cold water and heated before it is ready to use. *soaked*
18. Clamps should be applied while the ..... is still hot. *glue*
19. For ..... linseed oil should be used. *outside paint*
20. All new paint brushes should be ..... before they are used. *cleaned*
21. Oily rags should be put in closed ..... container. *metal*
22. Clear shellac should be kept in ..... containers to prevent discoloration. *glass*
23. Shellac makes a good filler for ..... grained wood. *close*
24. Linseed oil is made from ..... seed. *flax*
25. The best outside varnish is called ..... varnish. *spar*

Score for Part III is number right:.....

THE VALUE OF TOOLS

Man is weak of himself and of small stature. He stands on a basis, at most for the flattest soled of half a square foot insecurely enough, nevertheless, he can use tools, can devise tools. With these the granite mountains melt into light dust before him; he kneads glowing iron as if it were soft paste; seas are his smooth highways; wind and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing; with tools he is all. — *Thomas Carlyle.*

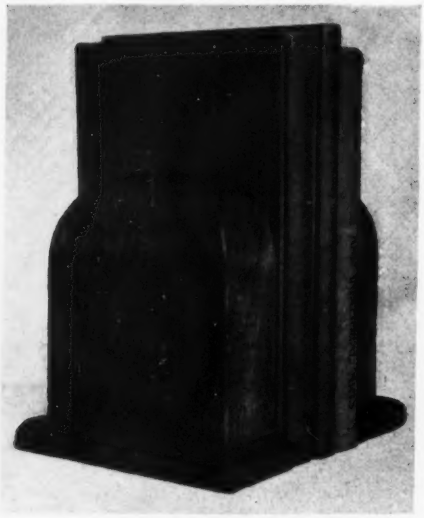
Problems and Projects

SIMPLE BOOK ENDS

Ralph M. Merry, High School, Malden, Massachusetts

These loaded book ends will stay in place anywhere. They are not only useful, but very attractive when embellished with an initial or monogram.

Material Needed: Two pieces 1¾ by 5⅛ by 6 in.; two pieces ½ by ¾-in. molding, 12 in. long. Black walnut is preferred but any suitable cabinet wood may be used.



Directions for Making: Square up the two pieces for the ends. Lay out the 1⅞-in. radius on the two top corners and on the top outside end. Saw down to these curves on the band saw or work down by hand with edge tools, working down the outside top end first and the top corners last. Remove the arrises left with file and sandpaper.

Bore the three 1-in. holes into the bottom and connect the center one with the two outer ones, by means of ⅜-in. holes. Pour melted lead into the center hole until the lead fills all three holes. Fit the molding around the front and sides of the book ends with mitered joint. Glue and brad on.

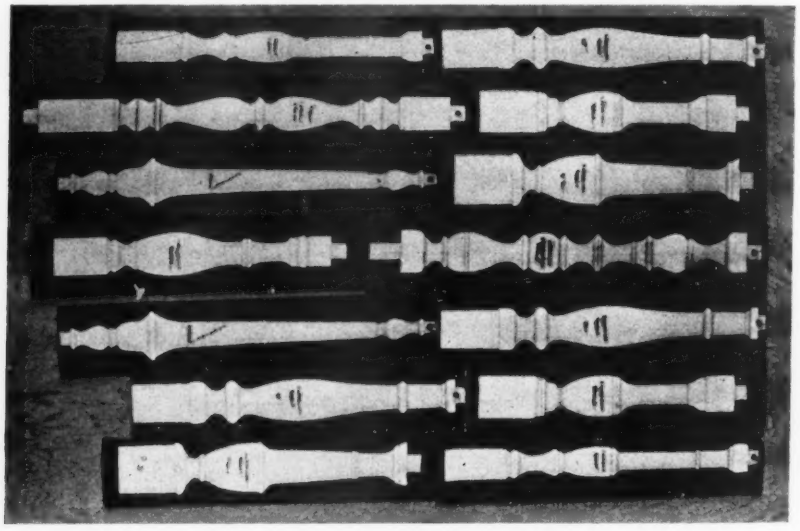
Design a monogram or initial and transfer to the book ends with carbon paper. The monogram may be carved, stained, or pierced. Score the lines deeply with a knife to prevent the stain from running.

Finish the book ends with several coats of shellac, rubbing down well between coats. Lastly, give them a coat of wax. A thin piece of felt or blotter may be glued to the bases to prevent marring.

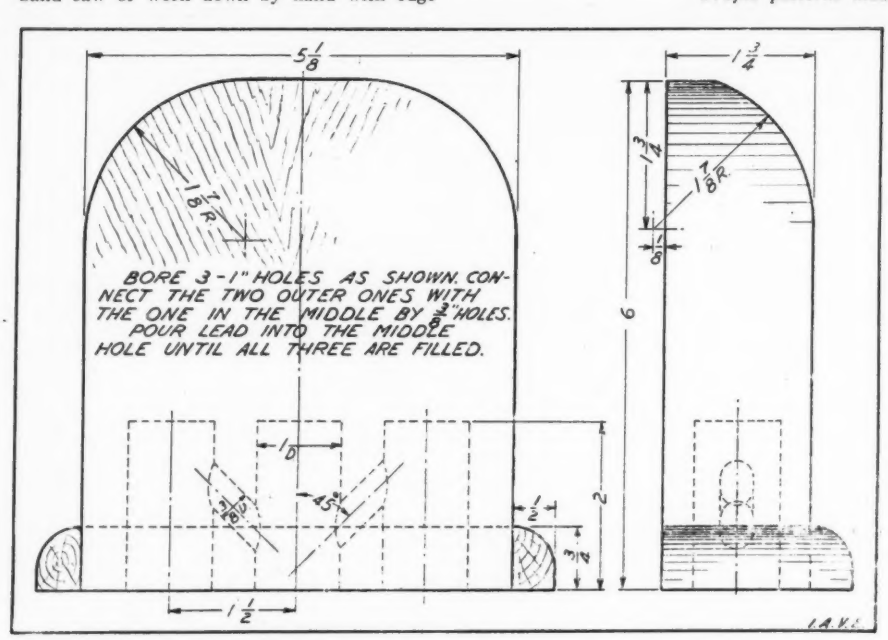
PATTERNS FOR WOOD TURNING

Deane E. Eldridge, Junior High School, Plymouth, Massachusetts

The purpose of this article is to show one way in which spindle turnings can be made more easily and accurately by the beginner. Even the experienced turner will doubtless see an advantage in using this method if he does not already do so. Since the wood-turning lathe is the least dangerous of all of the wood-working machines, it is usually the one which the pupils are allowed to operate first. Because of the boy's eagerness to use this machine he is apt to be so entranced by its operation that he overlooks the need for following any definite pattern. The result is usually that his work suffers from a series of meaningless curves, poorly arranged and poorly executed. The old saying that "a project is as good as its design" holds good here. The novice often finds the usual type of wood-turning blueprint difficult to follow. The dimensions confuse him and the drawing is so much in miniature that he finds it difficult to know exactly what his work will look like when completed.



Profile patterns made for the wood turner



Book end by Ralph M. Merry

The accompanying illustration shows how the writer has solved this problem. Patterns are cut full size from heavy drawing paper. To do this, fold the paper, sketch the design and then cut it out. When the paper is opened, the design may be studied for gracefulness of contour, grouping of details, and proper spacing to insure harmony and balance. When the pattern is a copy of an actual piece of turning this job is comparatively simple but when an original design is being created, it often

means continued trials before the final pattern is obtained. In either case the design when completed will be in actual size and proves much more useful in later marking and transferring the measurements onto the revolving piece.

In the actual use of these cut-out patterns trouble at once followed because they became entangled in the turning and were frequently badly torn. This necessitated a fresh supply to replace those worn out. To overcome this the patterns may be mounted on wallboard or thin plywood. Several coats of shellac prevent curling at the corners. These patterns, so mounted, serve as a visual aid during the turning process, since they may be held beside the revolving spindle so that the contours can be compared.

Such a group of patterns represent considerable work on the part of the instructor but they tend to cut lathe instruction to a minimum. If carefully cared for, the patterns will last for several years. The instructor should keep a master set of "cut-outs" on file so that replacements can be made easily.

DESK, RADIO, OR END-TABLE LAMP

S. H. Puehler, Public Schools, Milwaukee, Wisconsin

The lamp described herein taxes the creative instinct and supplies a desirable addition to any home.

While it is desirable and very evident that many variations can be applied in the making of the assembly and construction of parts used in this lamp, the discussion, here given, will deal primarily with the one pictured.

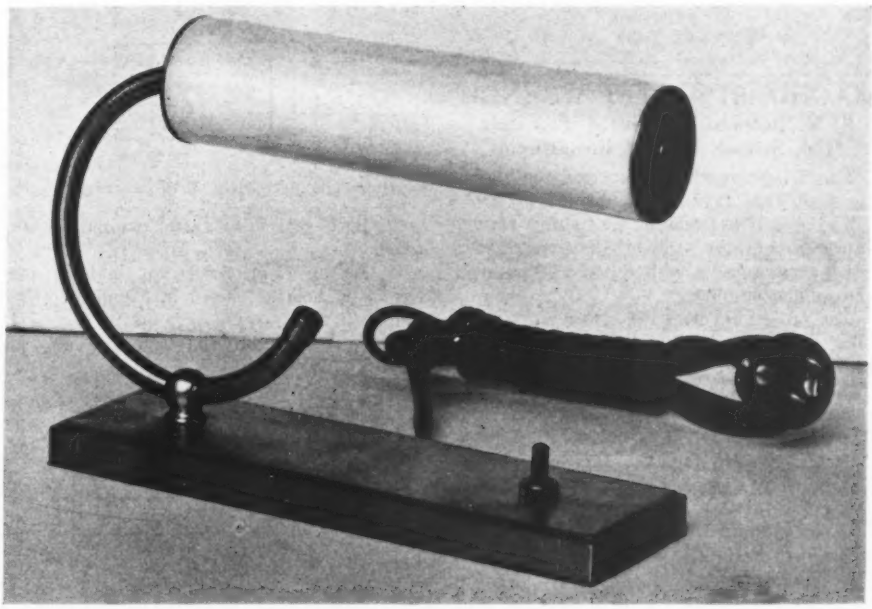
The base is made of ½ by ½ in. square metal with a 1/16-in. sheet of metal enclosing the top surface. After the 5/16-in. grommet hole and the ⅜-in. holes for the switch and brass elbow have been drilled, the parts can be soldered together in one operation by placing the clamped parts over a gas flame and applying solder. File cuts ½ in. from the four corners in each direction may be added for decorative purposes and for camouflaging the visible butt joints. Mitered corners can also be used, but are more difficult to make. A wood base, leaded for weight, may be substituted and fits in well with the modern trend in natural finished wood furniture.

The grommet for the wire entrance hole in the base comes in brass or nickel finish and may be obtained at tent and awning supply house. This item seems to be far less clumsy than the customary bakelight bushing. A press fit holds it securely into the base.

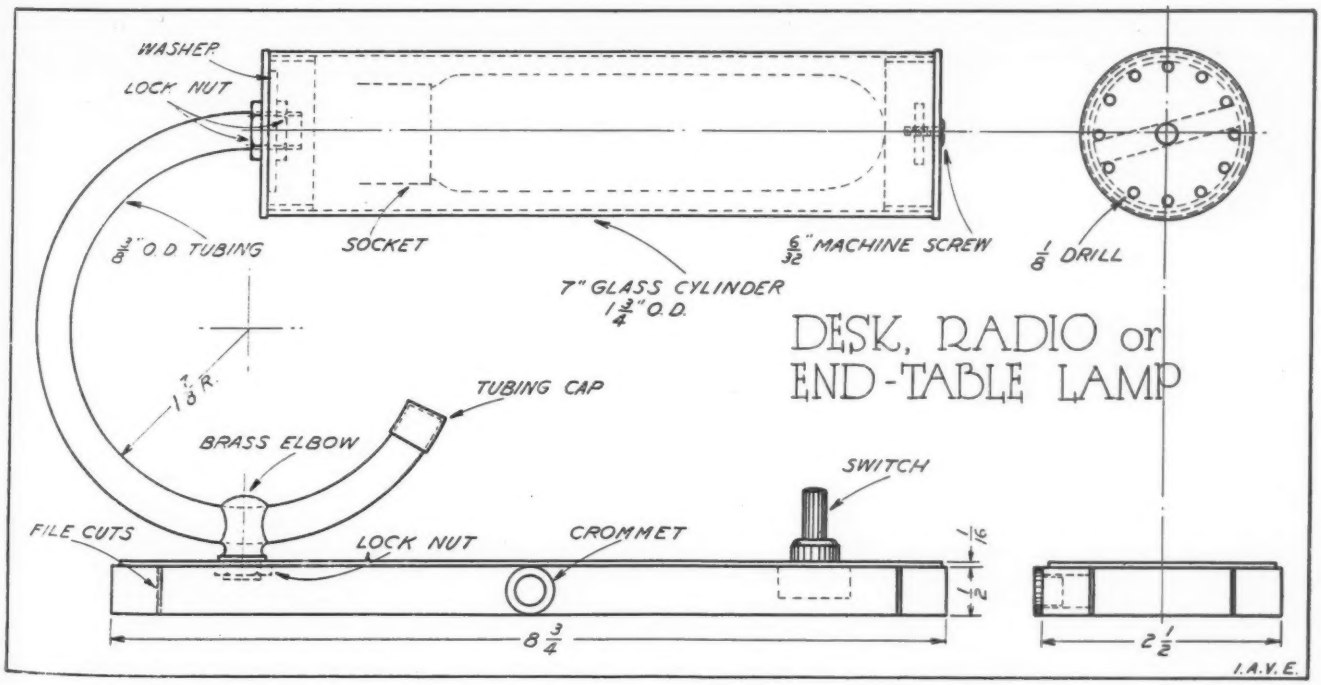
The switch may be any one of several on the market providing the enclosure part under the base is less than ½ in. in depth.

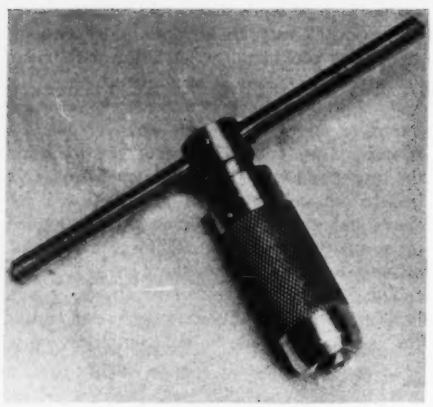
If the lamp is to be used for desk purposes, the glare on the eyes may be overcome by inserting a piece of transparent gelatin inside the upper half of the glass cylinder. This transparent gelatin is the material used for flood- and spot-light purposes and is supplied in a variety of colors. The green or blue appears to be easiest on the eyes.

This lamp also makes a neat appearing wall bracket fixture. In this case the upper end of the glass cylinder can be left completely open.



A novel lamp by S. H. Puehler





A machinist's T-tap wrench

MACHINIST'S T-TAP WRENCH

B. K. Beauchamp, United Township High School, East Moline, Illinois

The T-tap wrench is a practical tool, holding small taps ¼ in. or smaller.

The operations involved are turning, facing, knurling, chucking, drilling, threading in the lathe, taper turning with the compound rest, and milling or filing.

The project involves the fitting and assembling of machined parts with micrometer fits, or sizes.

Time allotment: Twenty-five 50-minute periods.

Materials:

1 pc. 1 by 3⅛ in. c.r.s.
1 pc. 1 by 2¾ in. c.r.s.
1 pc. ½ by 2½ in. c.r.s.
1 pc. ¼-in. drill rod 4¾ in. long
1 pc. 26-gauge steel-spring wire

Procedure:

1. Center, face, and straight turn the 1 by 3⅛ in. piece for the outside of tap wrench as shown in Figure 1.

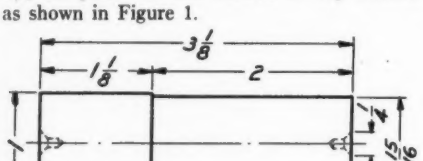


Fig. 1

2. Back gear the lathe and knurl as in Figure 2.

3. Disengage back gears, raise and tighten bull-gear clamp.

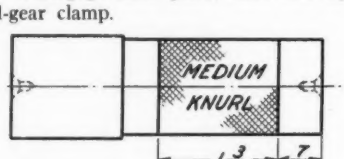


Fig. 2

4. Set compound rest and cut taper on right end as in Figure 3.

5. Set cutoff tool on center line and cut off as in Figure 3.

6. Remove setup from lathe.

7. Mount universal chuck.

8. Reverse work and mount in universal chuck. (Use copper strips to protect knurl.)

9. Chuck ⅜-in. drill in tailstock and drill

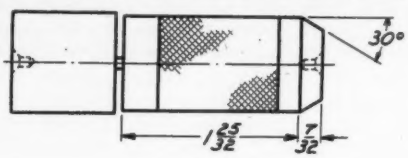


Fig. 3

full length of stock.

10. Follow with ⅝-in. drill, drilling 1¾ in. into stock.

11. Use reaming tool and cut inside taper at 30 deg. as shown in Figure 4.

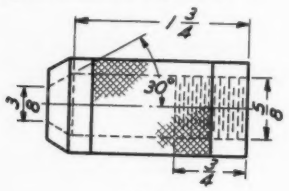


Fig. 4

12. Back gear lathe again and put in low speed.

13. Set up ¾-in. S.A.E. tap in lathe and tap ⅝-in. hole as shown in Figure 4. (Use plenty oil.)

14. Reverse lathe and run tap out of threads.

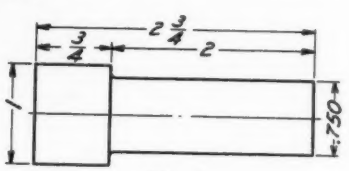


Fig. 5

15. Polish with fine emery cloth and oil.

16. Mount 1 by 2¾ in. stock in universal chuck allowing 2 in. to project from chuck.

17. Face and straight turn as in Figure 5.

18. Neck and turn as in Figure 6.

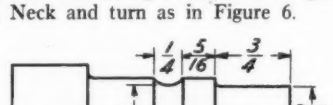


Fig. 6

19. Set lathe for cutting 16 threads per inch.

20. Set threading tool on center line and check with gauge.

21. Have setup checked by instructor.

22. Chase thread as in Figure 7 using plenty oil.

23. Cut thread.

24. Use outside of tap wrench, already made, as gauge for thread being cut.

25. Cut taper as shown in Figure 7.

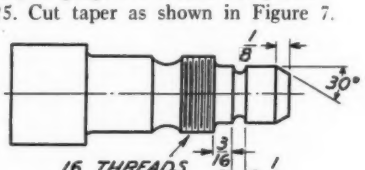


Fig. 7

26. Neck as in Figure 7.

27. Set up cutoff tool and cut off as shown in Figure 8.

28. Reverse cutoff piece in chuck and cut taper with compound rest as in Figure 9.

29. Set up in chuck in milling machine, 3/64 in. off center, and with R.H. single-angle cutter of 60 deg. mill as shown in Figure 10.

30. Revolve work in chuck with indexing crank to cut opposite angle.

31. Cutter must be fed vertically to give straight seat for jaws.

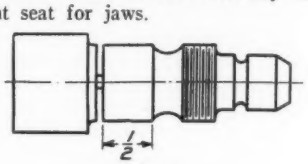


Fig. 8

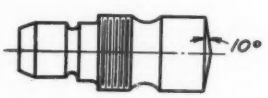


Fig. 9

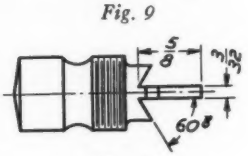


Fig. 10

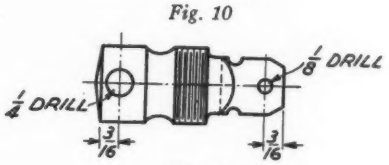


Fig. 11

32. Drill holes as shown in Figure 11.

33. Use a piece of ¼-in. drill rod 4¾ in. long for the handle of the tap wrench.

34. Taper ends at 80 deg. in chuck on lathe. Use compound rest.

35. Dress one half of drill rod lightly with fine emery cloth in lathe chuck, and polish.

36. Drive half way through the ¼-in. hole, as shown in Figure 11, with a lead mallet.

37. Set up the ½ by 2¼ in. stock in the universal chuck on lathe. Face one end. Cut V slot 3/16 in. from end and 1/6 in. deep as shown in Figure 12.

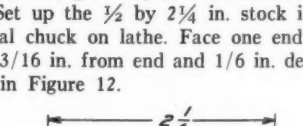


Fig. 12

38. Remove from lathe chuck.

39. Set up stock in chuck of milling machine with face end projecting 1¾ in. beyond chuck.

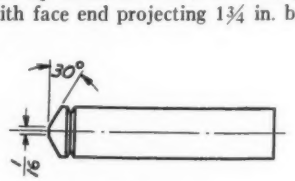


Fig. 13

40. Again use the single 60-deg.-angle cutter and cut angles as in Figure 13. Revolve

stock in chuck with indexing crank to cut opposite angle.

41. Without removing stock from chuck, set up 1/16-in. slitting saw and cut stock in half, as shown in Figure 14, to make the two jaws of the T-tap wrench.

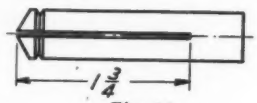


Fig. 14

42. Remove from mill chuck.

43. Mount in universal chuck on lathe with slotted end projecting.

44. Cut off with cutoff tool as shown in Figure 15.

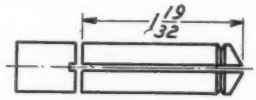


Fig. 15

45. With faces of two cutoff pieces together chuck in lathe and taper opposite end as shown in Figure 16.

46. Remove from lathe chuck.

47. Set up each jaw separately in vise on milling machine being careful not to clamp

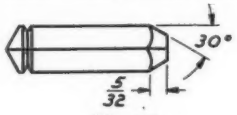


Fig. 16

too tightly and to support from bottom side.

48. Set up 90-deg. double-angle cutter, and mill each jaw as shown in Figure 17.

49. Caseharden jaws.

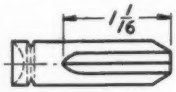


Fig. 17

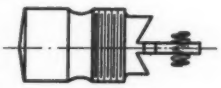


Fig. 18

50. Wrap spring wire (piano wire) around a 1-in. wire brad, held in jaws of a chuck, for the coil compression spring as shown in Figure 18, the purpose of which is to hold the jaws open.

51. With remainder of spring wire form into a circle ½ in. across with the ends overlapping ⅛ in. The purpose of this spring is to hold the jaws in place.

52. Stamp class letter and your number on the outside of tap wrench at the tap. (Stamp lightly.)

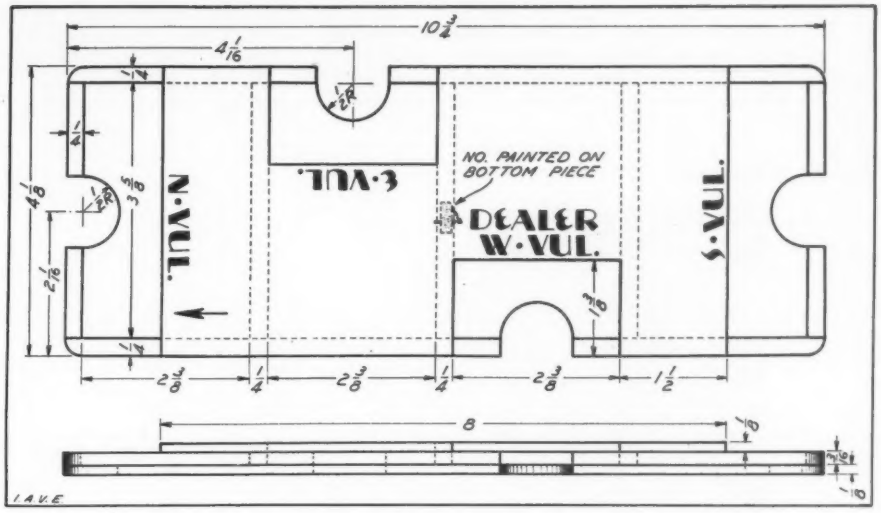
53. Assemble T-tap wrench.

DUPLICATE BRIDGE BOARD

Felton L. Harlan, Senior High School, Reading, Pennsylvania

The duplicate bridge board project will have its greatest appeal to the expert bridge fan. Duplicate bridge places emphasis on the bidding and playing of a hand and entirely eliminates the luck factor in drawing of cards. The 16 boards can be played in about 3 hours, thus constituting a pleasant evening of bridge.

Duplicate boards are a luxury, retailing between $5 and $15 for a set of 16. The set shown is very inexpensive, as the material will cost 50 to 75 cents at the most.



Duplicate bridge board

Method of Procedure

1. Cut 16 pieces ⅛ by 4⅛ by 10¾ in. for the bottoms.

2. Cut out 32 pieces 3/16 by ¼ by 10¾ in. for the side partitions.

3. Cut out 80 pieces 3/16 by ¼ by 3⅝ in. for the transverse partitions.

4. Glue partitions to bottom as shown, holding them in place with ½-in. No. 20 brads. The brads are to be removed when the glue has dried.

5. Cut out the finger slots.

6. Shellac the inside of all pockets.

7. Cut out 16 pieces ⅛ by 4⅛ by 10¾ for the tops.

8. Fasten tops in place with glue and brass escutcheon pins.

9. Give the top, bottom, and sides a coat of shellac. When dry, rub down with 4/0 sandpaper.

10. In lettering and numbering the boards, place the numbers on the bottoms of the boards. It is well to letter the word *dealer* in a different color from the rest of the lettering.

Number and letter the boards as follows:

Board No.	*Vulnerable*	*Dealer*
1	None	N
2	N-S	S
3	E-W	E
4	All	W
5	N-S	N
6	E-W	S
7	All	E
8	None	W
9	E-W	N
10	None	S
11	All	E
12	N-S	W
13	All	N
14	None	S
15	N-S	E
16	E-W	W

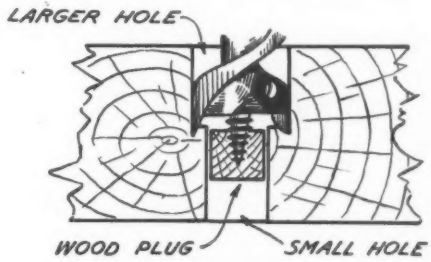
Apply a second coat of shellac over the lettering.

The best material for the boards is either walnut, mahogany, or tempered masonite.

REBORING A HOLE TO A LARGER DIAMETER

Carl von Lindeman, Western State Teachers College, Paw Paw, Michigan

Quite often it becomes necessary to rebore a hole larger than the previous one. This becomes a difficult task since the center for the bit is lost, but it may be made simpler if the following methods are employed.



Select a dowel that fits the previous hole, and into its center screw the bit center, as illustrated in the drawing. The larger hole may now be bored without difficulty. *Auger bit guides* which consist of a brass disk having a soft metal center into which the spur of the bit can be screwed may be purchased, but these are so seldom used that very few shops have them as part of the equipment.

PAINT BENCH AND BRUSH HOLDERS

Don L. Olson, Public Schools, Dawson, Minnesota

The tall cans in the center of the upper shelf of the paint bench shown in Figure 1, are the containers in which brushes are suspended in a solvent. When a brush is needed, the cover of the container is taken off, then the surplus turpentine, alcohol or lacquer thinner in the brush is drained off, and the brush is ready for use. After using, it is again returned to its proper place. There is a complete unit for each of the commonly used colors and one for shellac, stain, and varnish. Each unit is painted a different color. For example, if a project calls for red enamel, the boy gets out the red unit, takes

off the cover, picks the proper brush, drains off the surplus turpentine, and dips it into the enamel. After finishing the job, he again returns the brush to the proper unit. Figure 2 shows how each unit is constructed. A No. 2 can is fastened down near the end of a 2 by 6 by 12 in. block. This can is large enough to hold three brushes. The tall can, used as a cover, is made of two larger cans, soldered together and then cut to a height of about 9½ inches. The middle can is made of an old pineapple can which fits loosely over a wood disk, 1 in. thick. This can is used for mixing various shades of paint or for holding quantities of shellac, varnish, or stain. The smallest can is an old water-color dish. This also fits over a disk, which holds it in place. This can is used for holding and mixing small quantities of finishing materials.

The first unit is painted white, for white paint brushes; the second, red; the third, green; another blue; and still another black; for the various enamels and paints. The unit for the stains is painted brown. The one for shellac is painted orange, and the one for the varnish, silver. Each unit slides into a stall of its own, and can be taken out and used on a near-by bench if wanted or left on the rack and the brush removed and used where desired.

Using this method, the brushes need only be cleaned thoroughly three or four times a year, except the varnish brushes, which should be taken care of more often.

The five 2-gallon cans on the right contain liquids commonly used in a shop. Each is fitted with a ¼-in. brass faucet soldered on. Labels are painted on in red.

The middle shelf holds various small cans of paint and enamel, wood filler, and other common finishing materials.

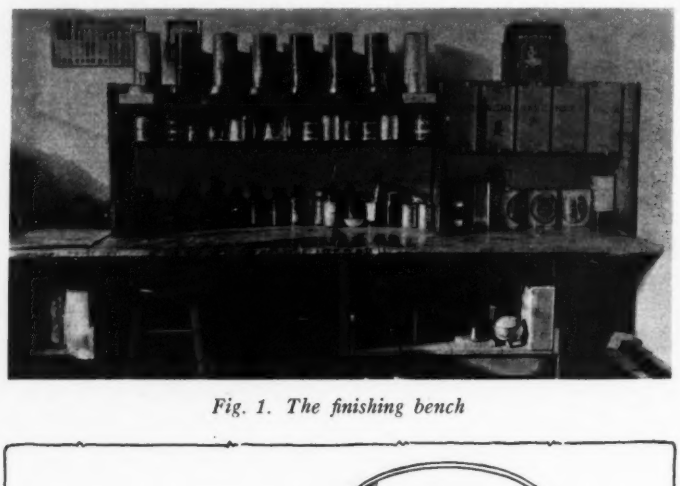


Fig. 1. The finishing bench

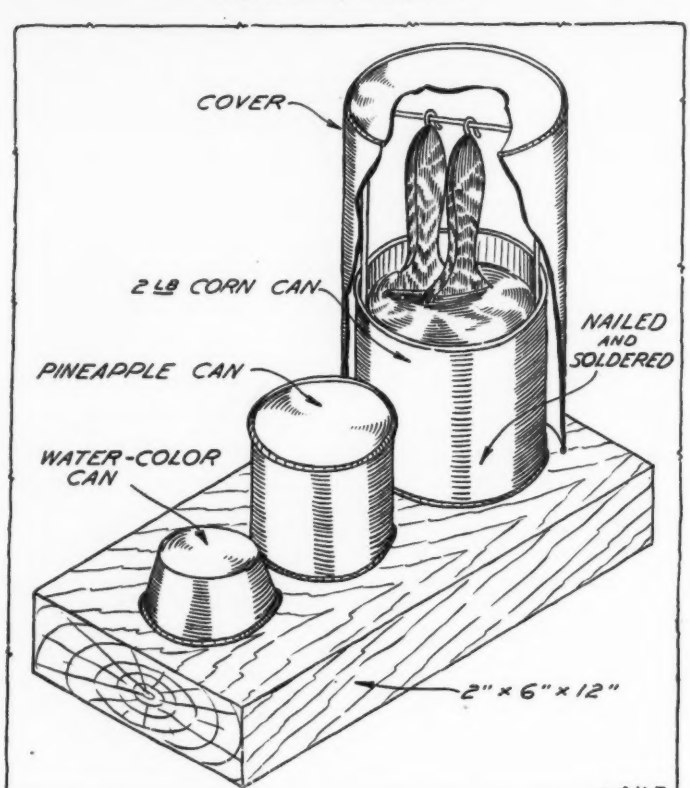


Fig. 2. Brush unit

METAL TINNING

Harry M. Dexter, Central High School, Grand Rapids, Michigan

It is well known that articles which are called tin are not made of tin at all. Tin cups, tin cookie cutters, tin funnels, etc., are all made, not of tin, but of iron that has been coated with tin. If these articles were made of pure tin, they would be entirely useless, because pure tin is too soft and also very expensive. No doubt, many teachers of metalwork know how tinning of metals is done, but for the benefit of the many students of metalwork who do not, the method is described here.

As a demonstration for the students, it is well to take a sheet of iron that is very rusty and show how the tinning may be done. Naturally, if a rusty piece of iron is used, the tin plate will not be as smooth as if a clean sheet had been used. With the tinning process, it is just as with electroplating. If the plating or tinning is done on a piece of smooth metal, the result also will be smooth and flawless.

Method of Procedure

As is well known, iron generally is coated more or less with an oxide. This oxide must be removed before the iron can be tinned. To do this, soak the iron in a diluted hydrochloric-acid bath or in a cyanide solution. When the oxide is entirely removed, the iron will appear clean and white.

Next, dip the iron into a bath of zinc chloride, after which place it into a container of melted tin where it is left long enough to come to the same temperature as the melted tin. By that time, if the iron was properly treated, it will be coated evenly with tin, and will be silvery and shiny.

Iron rivets are tinned in a similar manner. It is not necessary to dip each rivet individually into the acid and then into the melted tin. Instead, a large number of rivets may be placed in a wire basket which is dipped into the cleaning solution, the flux bath, and then into the melted tin. During these processes, the basket must be shaken frequently so all rivets will get the same treatment. When the rivets are coated with tin, the basket should be lifted out of the melted tin and shaken so the surplus tin will drip back into the container. Finally, the rivets are dumped on the shop floor to cool. They must be watched carefully so that they do not touch each other, because if they do, they will stick together after they are cooled.

When a larger article of iron or copper must be tinned, it may be impractical to dip it into the hydrochloric-acid and zinc-chloride baths, and then into melted tin. Instead, sponge the acid over a portion of the surface. Then pulverized tin must be prepared for use in this method of tinning.

Spread a piece of heavy cloth over a sheet of metal. Next, melt a quantity of tin over a very slow fire. Then allow it to cool until it is of the consistency of soft putty. While the metal is cooling, it must be stirred con-

stantly with a piece of wood. A metal stirring rod should not be used, because the melted tin would not only be chilled by the cold metal, but would stick firmly to the rod. Therefore, use a wood paddle and continue stirring until the melted tin starts slowly to thicken. Then quickly dump it out on the cloth and immediately fold the cloth over it so that the metal may be vigorously rubbed between the hands until it turns into fine pulverized tin. If too many larger lumps are left in the pulverized metal, it may be screened.

Next, swab zinc chloride over the portion of the metal article previously cleaned and then powder the pulverized tin over it. The pulverized tin will stick to the acid-covered metal, and this must then be held over a slow gas flame. When the pulverized tin on the surface of the metal starts to assume the appearance of perspiration, wipe it with some waste which contains some ammonium chloride powder. This wiping should be done with a circular motion. Be careful not to heat the metal too much, otherwise it will assume a bluish hue.

Repeat the foregoing procedure with the portion next to the piece just tinned, and continue until the entire article has been covered. After the whole surface has been coated with tin, go over the entire piece, rubbing it briskly with a clean piece of waste.

If it is necessary to tin both sides of a piece of metal, both sides should be treated as described, at the same time. When the tinning process is finished, the article must be well washed in clean water, or otherwise the chemicals left on the surface will penetrate through the light coating of tin and attack the iron beneath.

OAK-LEAF DESK LAMP

Carleton F. Spencer, Student, and Amos G. Williams, Professor Industrial Arts, Western Union College, Le Mars, Iowa

This table lamp is chosen as being the best design submitted in a class of bench metalwork. Not only is its construction simple and practical, but two elements of design, the scroll and the leafy floral treatment, lend grace to the project.

Laying Out and Cutting Stock

Cut a piece of ⅛-in. iron pipe 9 in. long for the upright *A*. Before threading one end to accommodate a lamp socket, decide whether the surface should be peened or whether it should be polished with a file and emery cloth. Execute the surface decoration before doing the threading operation.

The base *B* is made of three separate pieces of ⅛ by 3¼ by 3½ in. wrought iron, each hammered to the general shape of an oak leaf. A thinner gauge of iron is easier to form, but 16-gauge sheet iron is definitely too thin for the purpose. Inscribe the outline of each leaf on the metal with a prick punch, remembering that hammering will increase the width and length of the metal.

Select a ⅜-in. cold chisel and carefully cut each blank. Then, holding a piece with heavy pliers or tongs, shape the iron with blows of a ball-peen hammer. Anneal the iron in a gas flame frequently, since hammering makes the metal tough and brittle.

To obtain a graceful convex curve on the upper leaf surface, place the metal upside down on a block of soft wood and hammer the iron heavily. Then, on its top surface, inscribe characteristic leaf veins, using a sharp cold chisel. Anneal the metal again. Smooth any irregularities on the edges with a file. Finally, use a small ball-peen hammer to decorate the upper leaf surface. Support the metal carefully under each hammer blow, so that the original curve will not be altered.

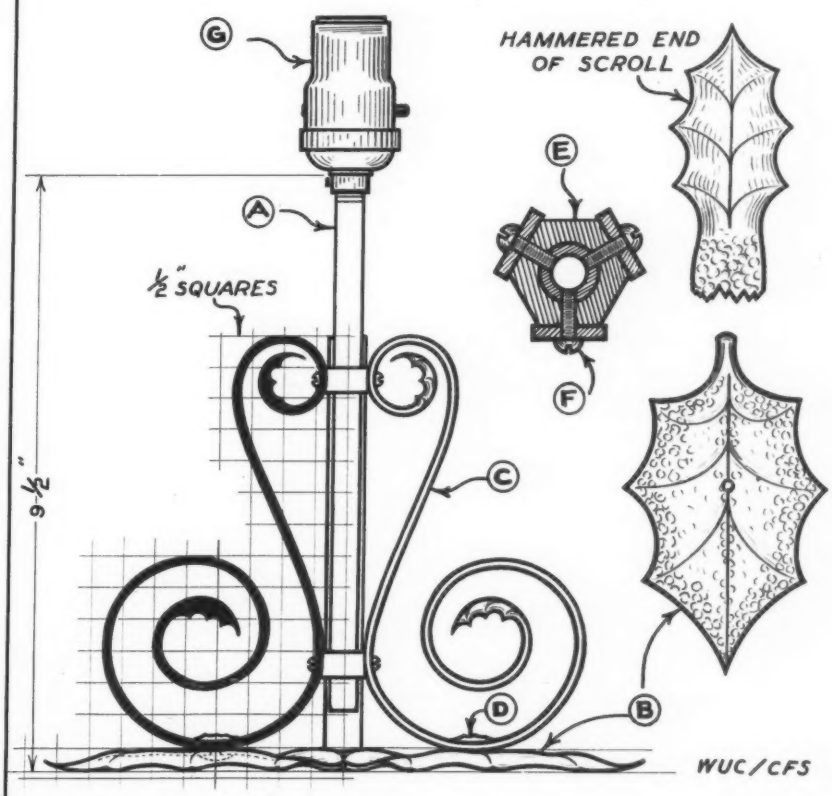
The legs (*C*) are three lengths of ⅛ by ½ by 15 in. strap iron. When peened, their length is extended one or two inches. The surface decoration is accomplished with medium or small ball-peen hammer marks. When peening, remember to emphasize the surface that shows on the upper and outer sides after the scrolls are bent to shape. Notice the illustrated leaf design of the ends. The treatment of the

Oak-leaf desk lamp

OAK LEAF
DESK LAMP

BILL OF MATERIAL

ITEM	UNIT	DESCRIPTION
Ⓐ UPRIGHT	1	⅛" IRON PIPE
Ⓑ BASE	3 pcs.	⅛" x 3¼" x 3½" WRT. IRON
Ⓒ LEGS	3 "	⅛" x ½" x 15" WRT. IRON
Ⓓ RIVETS	3	3/16" SOFT IRON, OVAL HD.
Ⓔ NUTS	2	⅜" HEX. HEAD
Ⓕ SCREWS	6	6-32 STEEL MACH.
Ⓖ LAMP SOC.	1	STANDARD, OXIDIZED
ELEC. CORD	1 pc.	8' LGTH. RUBBER CVD.
ELEC. PLUG	1	SMALL, FLEXIBLE



ends of the scrolls must harmonize with the leaf design of the base. Anneal the metal frequently when these ends are hammered. The leg scrolls are formed with a bending fork or other suitable bending jig.

Assembling Procedure

Drill out two 3/8-in. hexagonal nuts (*E*) so that the upright can easily enter the drilled opening. Then drill the legs to receive 6/32 machine screws (*F*) as illustrated. Drill and tap the hexagonal nuts and the upright to accommodate the legs as illustrated. If carefully done, this assembly is neat and sturdy

Drill a 3/16-in. hole in each of the three parts of the base. Drill the center of the lower scroll on each leg likewise. Select a 3/16-in. size of oval-head rivet (*D*), and fasten each base segment to a leg as illustrated. Before fitting the lamp with socket, wire, and plug, the metalwork must be suitably finished.

Finishing Procedure

Some prefer to polish the metal surface and then produce a series of "heat colors" by means of a gas flame. The brilliance of the violet, blue, and brown colors depends, first, on how well the surface is polished and, second, on how skillfully the heat is applied. Apply the flame only in spots. As soon as the bright metal turns violet or blue in color, remove the heat to another part of the surface. The mottled effect of heat coloring can be retained by applying a thin coat of clear lacquer after the project has cooled off. More than one coat will produce a glittering sheen which tends to cheapen the appearance of the lamp.

Another pleasing effect is obtained by burning linseed oil on the surface of the metal and then polishing the high spots with fine emery cloth. A coat of warm wax helps to prevent the appearance of rust spots.

Still another finish, quite easy to apply, is a coat of black enamel polished with emery cloth when dry. The high spots are thus made visible and may be prevented from tarnishing by applying a thin coat of clear lacquer. The use of warm wax is an optional method of preventing tarnish.

Wiring Procedure

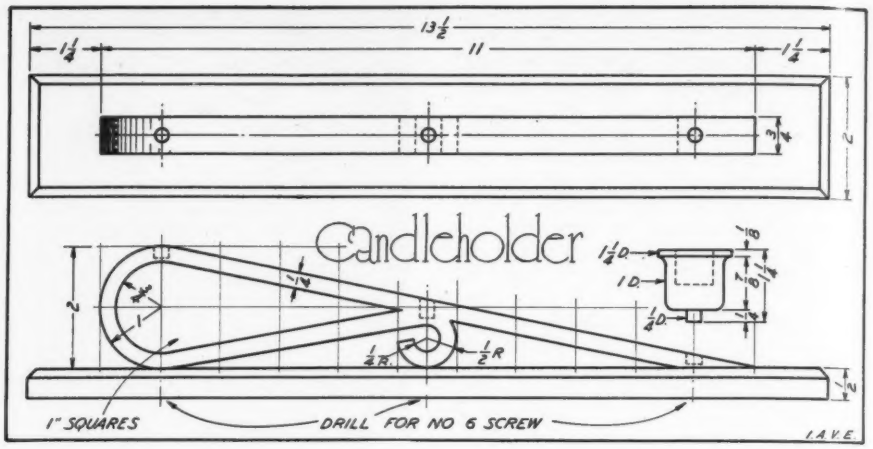
Attach a lamp socket, having any standard switch to the threaded upright. If possible, select a socket whose outer shell has a dark, oxidized finish. A brushed brass socket cheapens the lamp's appearance. Push eight feet of rubber-covered cord through the upright and attach a small flexible plug to the free end. Obtain a small lamp shade of the clip-on-bulb type. The project is then ready for service.

CANDLE HOLDER

Donald Towle, St. Johnsbury, Vermont

The candle holder described herein is a very attractive table center, varying from the old-type candle holder usually found in the school shops. Two of these holders used as table centers or as mantle-piece sets attract attention, and both student and parents like them.

It is an inexpensive project which involves a great variety of teaching units. The work does not entirely deal with the lathe, and gives a greater group of students the opportunity to use the lathe.



An attractive wood for this project is gum wood.

Cups:

The cups are made on the lathe in a group of three leaving a 3/8-in. distance between each. After cutting and sanding to exact size, cut so each cup has its 1/4-in. dowel at the bottom end. This part is later glued into the scroll.

Scroll:

Lay out the scroll on a sheet of paper and then trace on wood. The inside curves are cut using an expansion bit for the large circle and a 1/2-in. bit for the small curve. The curve is then cut, filed and sanded.

Base:

Cut wood to correct length and width. Bevel top edge.

Assembling:

Lay out for holes to hold scroll to base. Check to see if scroll is correct distance from each end and then drill and countersink. A No. 6 by 3/4 in. screw is used to hold the members together.

Lay out for the cup holes, using a No. 4 bit and boring down as far as possible, being careful not to go all the way through. Glue cups in place.

Several types of finish may be used.

(*a*) A clear shellac finish rubbed down with steel wool.

(*b*) A clear shellac base and cups, with a black shellac scroll. Either finish will prove satisfactory.

METAL PICTURE FRAMES

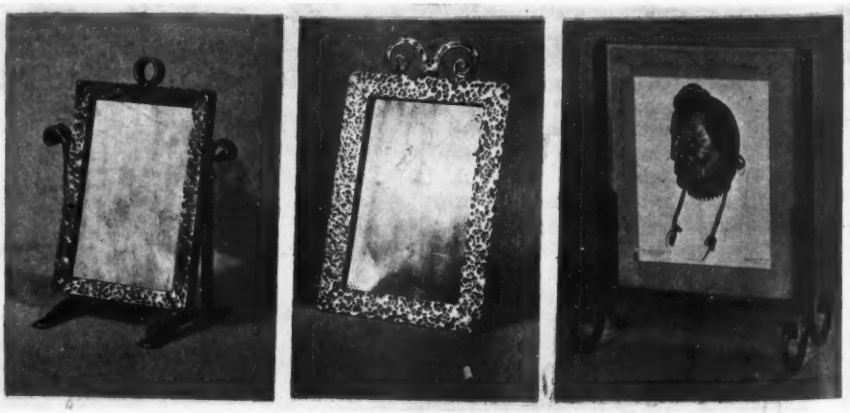
H. M. Andersen, Cicero, Illinois

The picture-frame project is one that we give early in the semester. We try to have each boy design a frame that will meet his needs. The three frames pictured here are only a few of the many that have been made. Those made for hanging may have a set of scrolls at the top center. Many have designs requiring covered miter joints.

The one shown with stand, is made of angle iron, either from stock or made of 18-gauge sheet steel formed in a bar folder. The feet and uprights are made of band iron and the top ornament is made of pipe. The construction is obvious. There are many ways of holding the back plate in position which can be worked out by the student with a suggestion or two from the instructor.

The frame with the scrolls at the top is made of T iron. Care should be taken to keep the frame light in weight. The scrolls are a part of the back brace which holds the frame at the proper angle. The base end of this piece is scrolled but not split, as is the top.

The other frame is a little more advanced, but not difficult for a careful student. Again the construction is easily seen. The portion holding the glass is 26-gauge sheet steel hemmed and formed in a channel shape. Three pieces are made mitered and welded. This section is then welded to the uprights. There are two pieces of glass holding the picture in position and another picture may be



Metal picture frames

backed up to this one to be viewed from the other side.

The most satisfactory way of finishing is to peen and polish, then rub with oil. Many striking effects, however, can be had by painting and then baring the steel in a few small places.

MODERNISTIC COMBINATION END TABLE, BOOKSHELVES, AND MAGAZINE HOLDER

Malcolm T. Howell, North Carolina State College, Raleigh, North Carolina

This combination end table, bookshelves, and magazine holder, is especially designed for the modern compact apartment. However, it may easily fit in with other furniture of any home.

It is easy to build, because of its simple design, simple construction, and simple lines. Any boy in the woodshop would enjoy working on the project, to see it take form, and be proud to exhibit the finished product as a result of his handicraft.

The author used ¾-in. white poplar and ¼-in. fir plywood. In finishing, the poplar was left natural, the plywood was stained walnut, and the entire project given three coats of pure white shellac, rubbing each coat with steel wool. After the final rubbing with steel wool a coat of furniture wax was applied and rubbed to a fine finish.

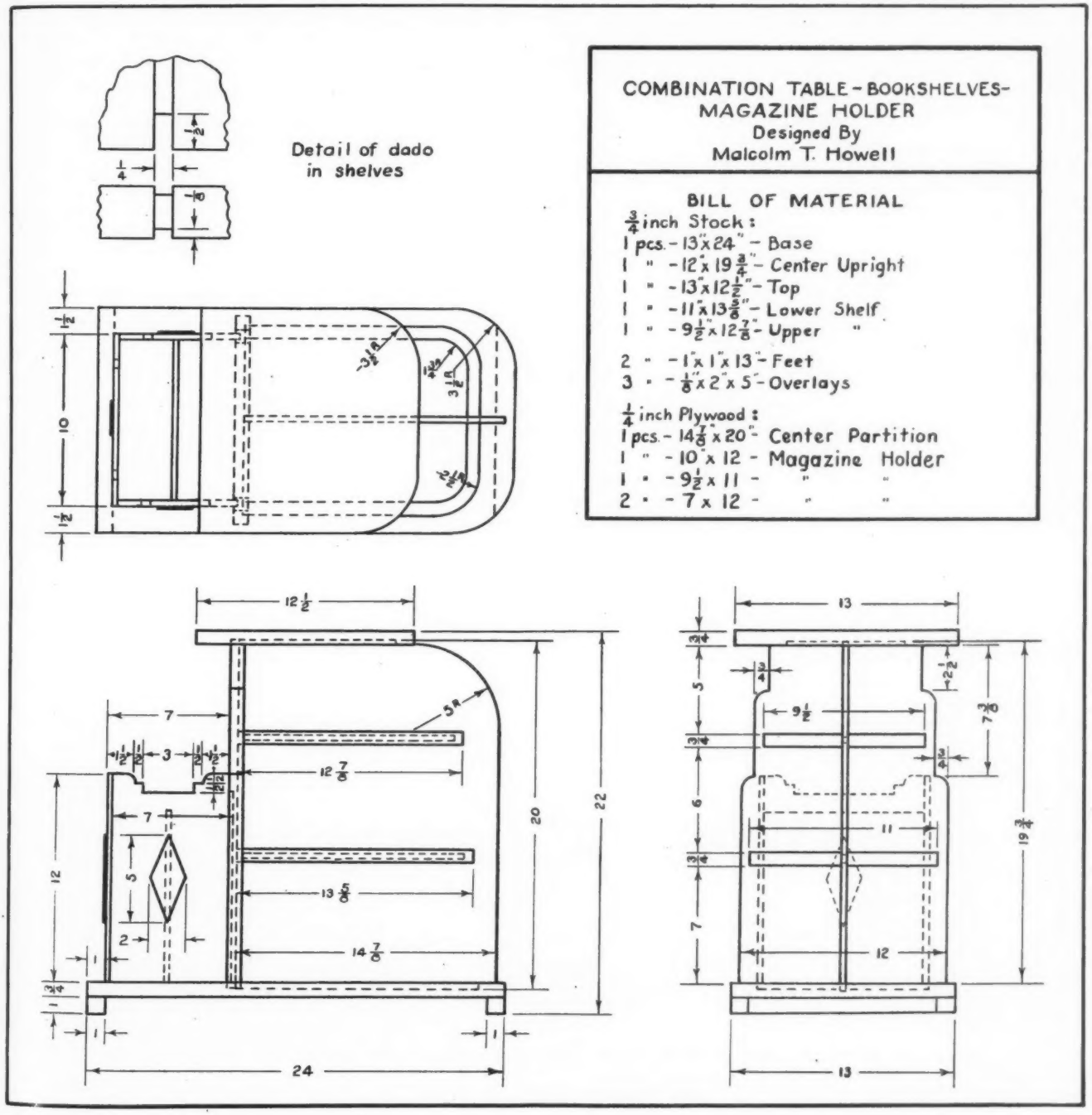
If a painted color combination is desired, the combination may be constructed of basswood, whitewood, or poplar with ¼-in. fir plywood. If made of either of these woods it may be painted in combinations of red and gold, black and silver, or black and white. Other color combinations may be desired so as to match other pieces of furniture.

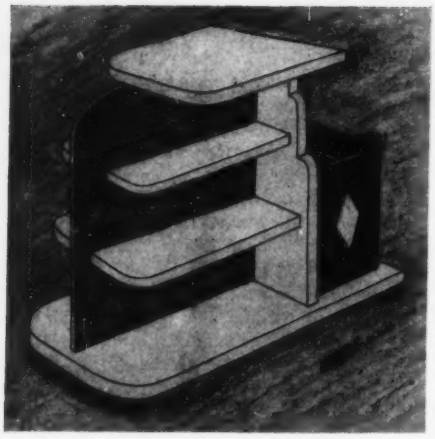
Maple and walnut is an excellent combination of woods for a natural finish, using maple for the ¾-in. stock and ¼-in. walnut veneer.

Procedure

Getting out the stock:

1. Joint stock and glue pieces for the ¾-in. stock, if 13 in. width is not available.
2. Dress to correct thickness and sand


Detail of dado in shelves
COMBINATION TABLE - BOOKSHELVES - MAGAZINE HOLDER
Designed By
Malcolm T. Howell
BILL OF MATERIAL
¾ inch Stock:
1 pcs. - 13"x24" - Base
1 " - 12"x19¾" - Center Upright
1 " - 13"x12½" - Top
1 " - 11"x13⅜" - Lower Shelf
1 " - 9½"x12⅞" - Upper "
2 " - 1"x1"x13" - Feet
3 " - ⅛"x2"x5" - Overlays
¼ inch Plywood:
1 pcs. - 14⅞"x20" - Center Partition
1 " - 10"x12 - Magazine Holder
1 " - 9½x11 - " "
2 " - 7x12 - " "



with belt sander if possible.

3. Cut stock to size, laying out all curves and sawing to shape.
4. Sand all edges to a smooth symmetrical surface.
5. Lay out and cut all dado joints (care should be taken to stop kerf and finish with hand chisel for hidden dado joints).
6. Lay out and cut two 9/16-in. slots in plywood center upright for upper and lower shelves.
7. Lay out and cut three diamond overlays. NOTE: After base has been cut to size and shape, the feet are cut, glued, and clamped in place so that the edges may be sanded smooth.

Assembly:

1. Before starting the assembly sand all pieces with No. 00 sandpaper.
2. Give all pieces to be left natural one coat white shellac.
3. Stain plywood before assembly, if other than walnut veneer is used.
4. Stain feet (use small brush being careful not to get stain on the end grain of the base), if other than walnut is used.
5. Glue and nail the ¾-in. center upright, from the bottom.
6. Glue shelves in slots of ¼-in. plywood center upright.
7. Glue plywood upright with shelves to the ¾-in. upright and base.
8. Glue and clamp top.
9. Glue and clamp diamond overlays to the three sides of magazine holder.
10. Assemble magazine holder and glue into dado joints of ¾-in. upright.

Finish:

1. Clean entire project by rubbing with steel wool.
2. Apply coat of white shellac.
3. Rub with steel wool.
4. Apply second coat of shellac.
5. Rub with steel wool.
6. Apply third coat of shellac.
7. Rub with steel wool.
8. Apply coat of furniture wax.
9. Rub with soft cloth to a fine, smooth finish.

If a color combination is desired, the colors must be decided on and the necessary changes made in the finish procedure.

TIN-CAN WHEELS FOR TOYS

Jos. J. Lukowitz, Milwaukee, Wisconsin

Excellent wheels can be made from tin-can bottoms. The entire can bottom, including the rolled edge must be used when making wheels. The bottom may be cut from the can with the type of can opener shown at B in Figure 2, page 283 of the September, 1936, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. This type of can opener removes the bottom without leaving any sharp protruding edge.

To make a wheel from a can bottom, cut the bottom from the can with such a can opener or with tin snips as shown on page 15 of *55 New Tin-Can Projects.** Then form the hub for the wheel just as described for the windmill wheel on page 203 of the June, 1937, issue of this magazine. This hub is very essential to prevent the wheel from wobbling. It may be made in various sizes to obtain different effects.

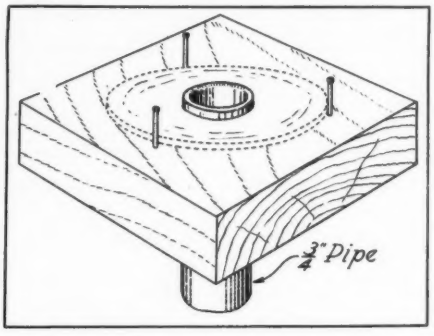


Fig. 1. Jig for forming hub in can bottom. Dotted line indicates position

Figure 1 shows jig which will insure getting the hub in the exact center of the wheel. Different size wheels of course require different location of the nails which center the can bottom over the pipe. A separate jig for each size wheel may be made. When the jig is in use the pipe is held in the vise and the wood rests on the vise.

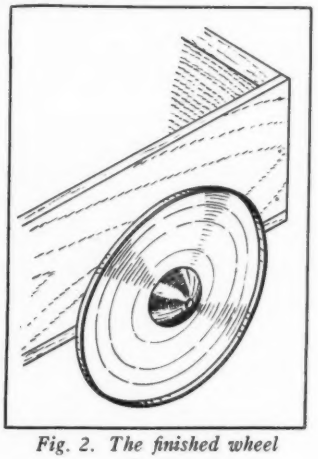


Fig. 2. The finished wheel in use

Figure 2 shows a finished wheel used as a wagon wheel.

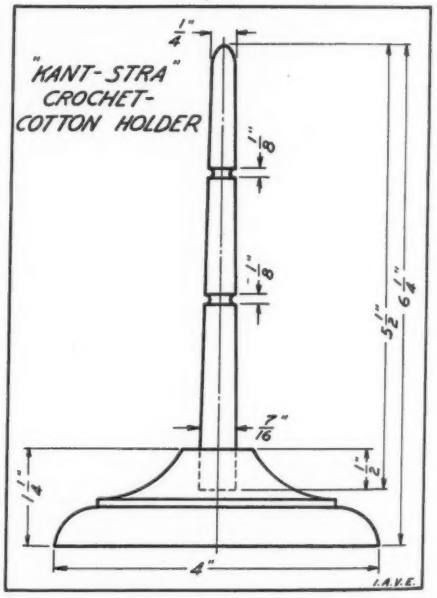
The utilization of used tin cans in the school shop has potential educational possibilities and certain advantages which some other forms of shop work do not have. The work possesses practically all of the learning situations involved in handwork for general objectives and in addition it contributes specific values such as planning, measuring and laying out, cutting, significance of squaring, filing, punching, bending, forming, soldering, jigs and quantity production, polishing, painting and decorating. All of the related information involved in connection with the materials, tools, and processes used forms a worth-while content for addition to any shop course. In addition, the elimination of material cost for projects is timely in our present economic stress and this advantage alone can do much to eliminate troublesome situations where school or pupil finances make it difficult or impossible to pay for required material.

*Published by The Bruce Publishing Company. Milwaukee, Wisconsin.

KANT-STRA CROCHET COTTON HOLDER

Frank Judish, Wilmington, North Carolina

The "Kant-Stra," holder of crochet cotton or yarns, has proven a successful project in my classes for the past two years. It can be made of wood or light weight metal and allows for some originality in design.



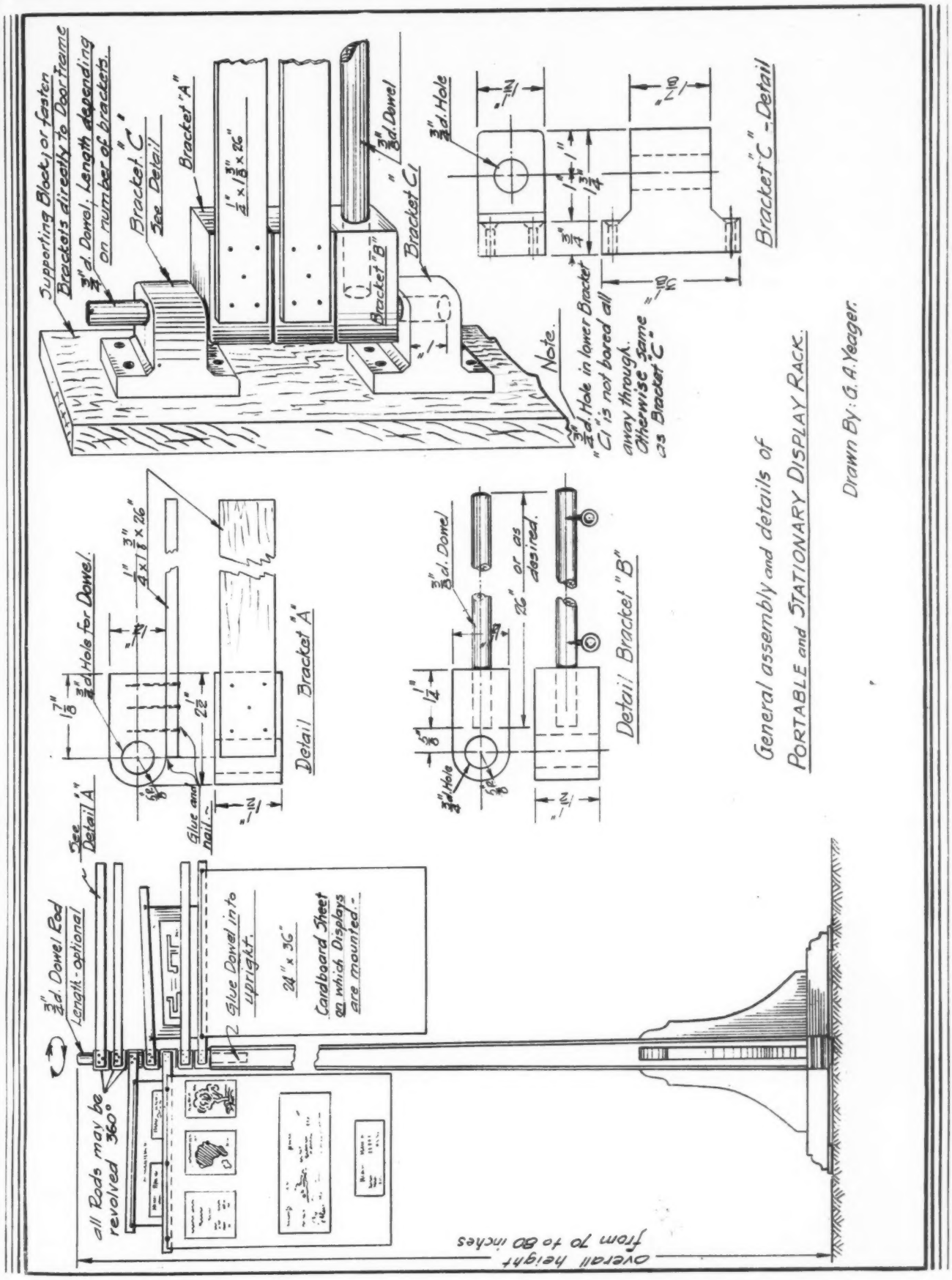
It consists of a spindle set upright in a base, that is either round, octagon, rectangular, or triangular.

The crochet cotton is placed on the spindle, and unwinds freely, without permitting the thread to fall to the floor and become tangled.

DISPLAY RACK

G. A. Yeager, High School, Clark's Summit, Pennsylvania

Display space for drawings, charts, and many other educational purposes, is at a premium in many shop, art, and other schoolrooms. The device illustrated has solved this



General assembly and details of PORTABLE and STATIONARY DISPLAY RACK.

Drawn By: G. A. Yeager.

problem for us, and also has provided us with a splendid practical project for the industrial-arts department.

The rack should be so constructed that it can be placed permanently in a selected location along the walls, windows, or door frames, or it may be built so that it can be moved from one place to another. In either case, it will answer the purpose and greatly enlarge possibilities for display.

The designs shown are fundamental in principle and may be changed to suit conditions, ability, material, etc., and this holds good for all parts. If made of wood, hard, close-grained wood for brackets, dowel rods, and blocks which support display bars, will be satisfactory. The upright may be of pine or gum.

If made of metal, the possibility of change in design and usefulness is even more pronounced and limited only by the constructive mind and ability of the student.

The illustration shows a general arrangement for a portable and a stationary display rack, with details for different styles of brackets and rods. It is practically self-explanatory, and will offer little difficulty in construction.

LAMP

R. A. Tomkiewicz, Bay View High School, Milwaukee, Wisconsin

The lamp described herewith has been very popular in the author's classes. It embodies many different types of operations and requires but little material.

Bill of Material

Base: One piece 20- or 22-gauge black sheet iron, 6¼ by 9¼ in.
Drip Cup: One piece 20- or 22-gauge black iron, 3½ in. in diameter.
Candle Socket: One piece 20- or 22-gauge iron, 4¼ in. square.
Shade: One piece 20- or 22-gauge black iron, 9½ in. in diameter.
Upright: One piece ⅛ by ⅝ by 27½ in. iron.
Miscellaneous:
One ⅛-in. short pipe nipple.
One ⅛-in. pipe check nut.
Two No. 8 by 4 in. fillister-head machine screws.
One ⅛-in. composition or metal electrical-socket bushing.
One No. 8 eyebolt with nut.
One standard electrical light socket.
One piece rubber-covered extension cord 8 ft. long.
One separable plug connector.

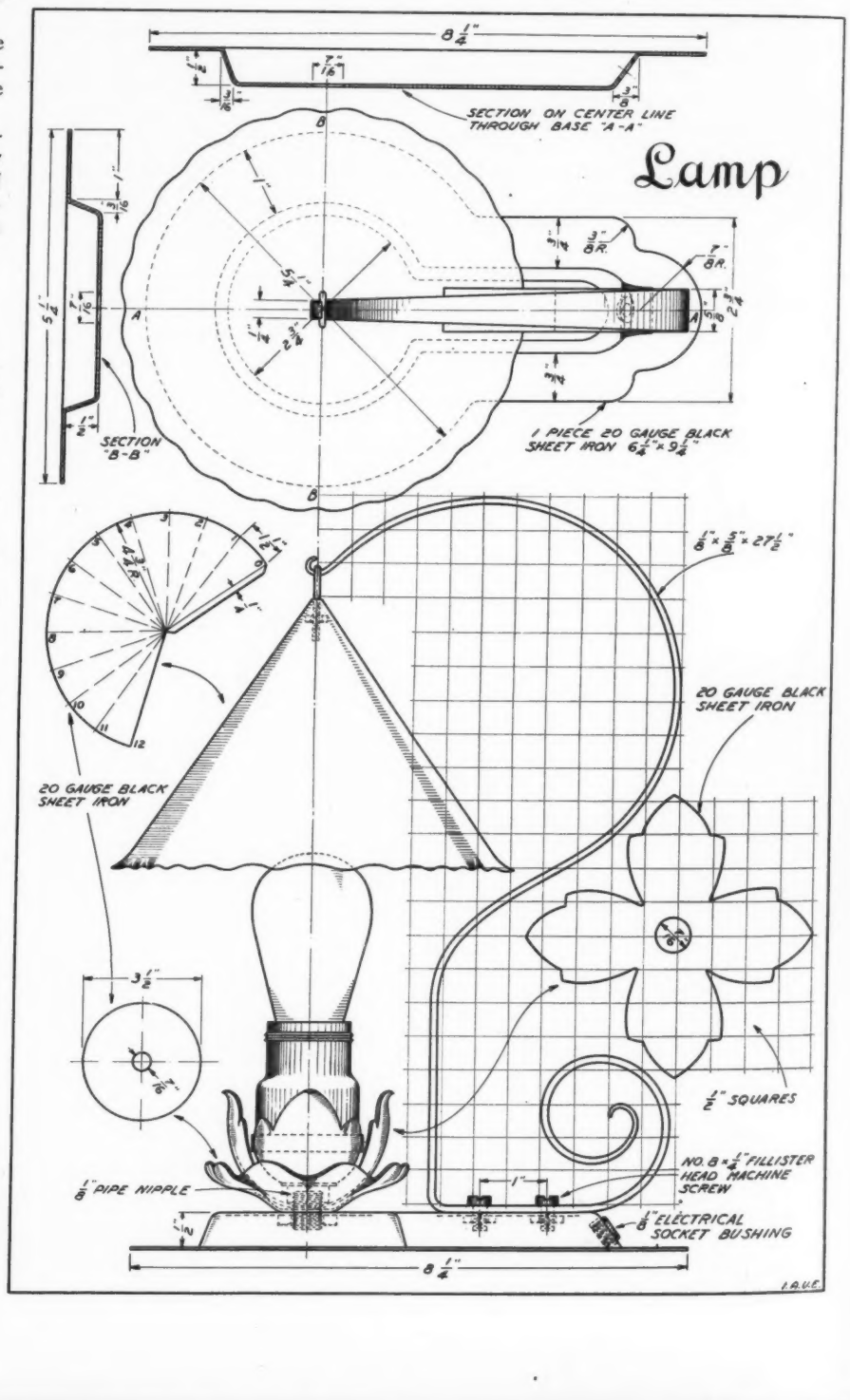
Method of Procedure

Base:
1. Cut a piece of black iron.
2. Shape the base.
3. Peen the metal.
4. Cut base to required form.
5. Drill all required holes.

Drip Cup:
6. Drill hole in blank.
7. Shape the cup.
8. Peen the cup.

Candle Socket:
9. Lay out design.
10. Cut out the form.
11. Shape the socket.
12. Peen it.

Shade:
13. Cut out the required blank.
14. Form it and rivet together. A small rivet placed near the outer circumfer-


Lamp
8 1/4"
SECTION ON CENTER LINE THROUGH BASE "A-A"
SECTION "B-B"
1 PIECE 20 GAUGE BLACK SHEET IRON 6 1/4" x 9 1/4"
1/8" x 5/8" x 27 1/2"
20 GAUGE BLACK SHEET IRON
20 GAUGE BLACK SHEET IRON
3 1/2"
1/2" SQUARES
1/8" PIPE NIPPLE
NO. 8 x 1/4" FILLISTER HEAD MACHINE SCREW
1/8" ELECTRICAL SOCKET BUSHING
8 1/4"
I.A.V.E.

ence of cone will hold the metal in place.

15. Peen the cone and flute the edge as shown.

Upright:

16. Cut the metal for the upright to shape.
17. Peen the metal for the upright.
18. Form scrolls and bends.
19. Drill required holes.

Assembly:

20. Fasten upright to base.
21. Fasten electric-light socket, candle socket, and drip cup to base as shown.
22. Fasten eyebolt to cone.

Finish:

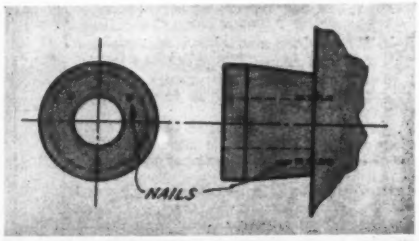
23. The lamp may be finished in natural color, protected by a coating of lacquer, varnish, or wax.

SOME USES FOR WRAPPING-PAPER CORE SPOOLS

Frank Bentley, Clinton, Iowa

Rubbers Hanger

Wrapping-paper core spools make excellent supports upon which light or heavy rubbers may be hung. To fasten the spools securely in place, drill three or four small holes in the face of the smaller end, making the holes about ½ in. deep. Cut the heads off shingle nails and tap them into the holes, leaving about ½ in. of the pointed end of the nails



extending. Tapping the larger end of the block will then force the nails into the wall where the rubbers are to be hung. As the taper of the spool is toward the wall, the rubbers cannot slip off, and the smooth, round surface of the spools does not pull or press the heel part of the rubbers out of shape.

Rubber-Band Holder

Wrapping-paper core spools also make handy holders for rubber bands. Remove the small holding band from the new packet of rubbers, and wrap the bundle of bands in either a strip of paraffin paper or cellophane, permitting about 2 in. of the wrapping to extend over one end of the bundle. Twist the

extending wrapper into something of a point and pull the packet of bands down into the hole in the center of the spool. Let about one fourth of the length of the bundle of bands extend from the top of the spool. Tear or cut off any surplus paper or cellophane projecting from the bottom. The bands may be easily pulled out, one at a time, starting with those on the outside of the bundle. They slip easily against the cellophane or paraffined paper lining. The one pulled on will be the only one that will come up and out. When the packet thins out and begins to loosen, simply punch a small wad of paper down into the center of the bunch until a new packet is put in the holder.

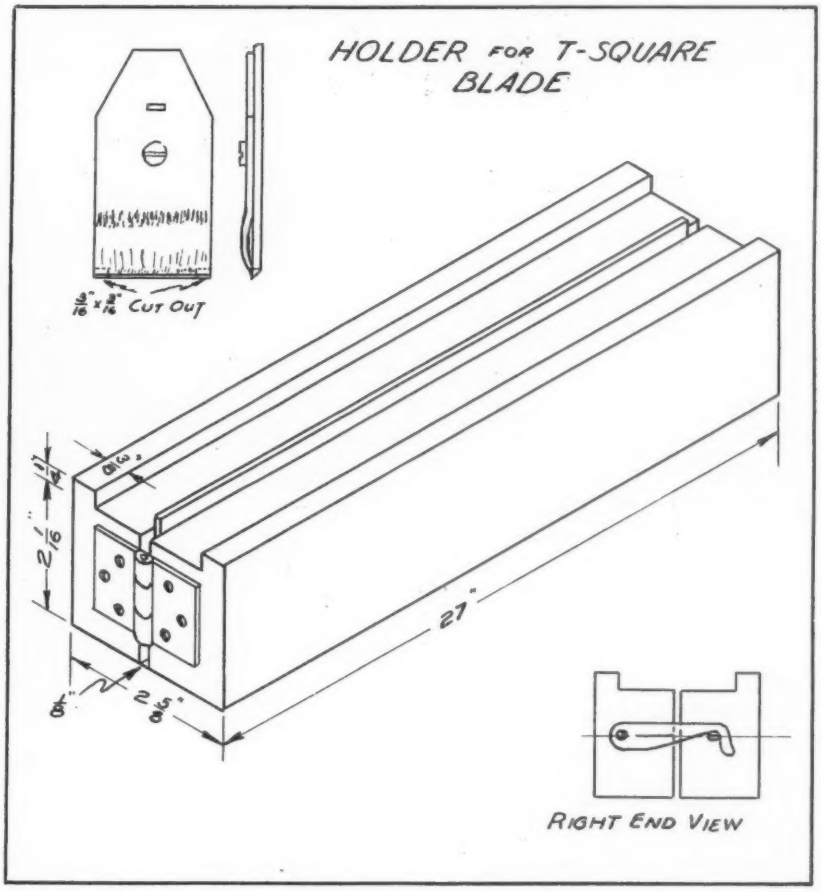
DEVICE FOR REPAIRING T-SQUARE BLADES

H. J. Bauman, High School, Port Huron. Michigan

The device described herewith will serve a useful purpose in every drawing room. Good work cannot be accomplished with a T square full of dents.

Just a few minutes will put a poor blade in perfect condition. Take off the head of the T square, insert it in the device so that the bottom of the T-square blade is flush with the bottom of the holder. Clamp it shut and put the entire holder in the bench vise, or use it against a bench stop.

The corners of the plane blade and shaving breaker should be ground off as shown. The plane will glide on the two rails while the plane blade may extend below this surface, depending upon the width of the T-square blade. The width of this device as well as the distance between the rails depends upon the size plane used.



INDIAN LADLES, BOWLS AND DRINKING CUPS

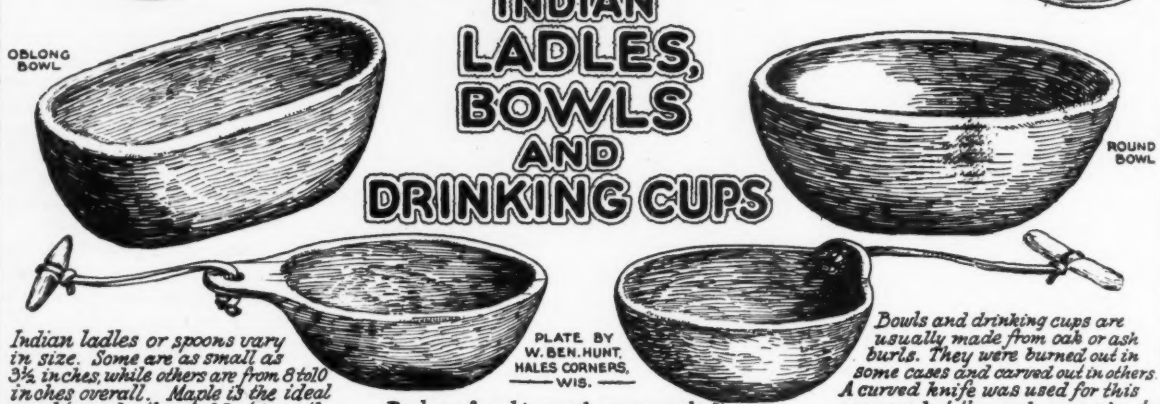


PLATE BY W. BEN. HUNT, HALES CORNERS, WIS.

Indian ladles or spoons vary in size. Some are as small as 3½ inches, while others are from 8 to 10 inches overall. Maple is the ideal wood to make them of but is rather hard to whittle unless they are first roughed out with a saw. Basswood is ideal for whittling and will not crack or check easily.

Burls are found in nearly every woods. It is surprising how many there really are when one is on the lookout for them. They are nature's way of healing a wound in a tree usually caused by a branch breaking off close to the trunk. Take along a sharp saw when hunting burls and saw them off as shown below. Green or live burls are much easier to carve than dead or dried burls.

Bowls and drinking cups are usually made from oak or ash burls. They were burned out in some cases and carved out in others. A curved knife was used for this purpose, but the work may also be done with a gouge. Bowls measure 6 to 10 inches across, while drinking cups are from 3 to 4 inches in length or diameter, depending on the shape of the vessel.

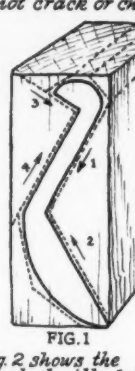


FIG. 1

Fig. 1 shows a block of wood with the outline of the side view drawn on one side of it. The saw cuts are shown by dotted lines. The block should be held in a vise.

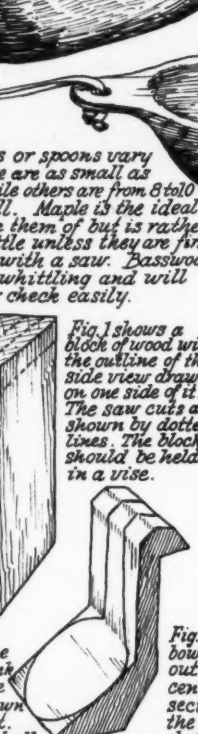


FIG. 2

Fig. 2 shows the roughed-out blank and the outline of the ladle drawn on the face of it. The bowl of the ladle should be hollowed out at this stage, because it is easier to handle while still in the square. Then if the knife or gouge should slip, the shape can be changed somewhat, whereas if the outside of the bowl is carved first, a slip may ruin the whole thing.

FIG. 3

Fig. 3 shows how the bowl should be carved out. Work toward the center, leaving a small section stand, "A", until the proper curve and depth is attained. It serves as a stop, and is cut off when the bowl is finished. The rest of the work is just a matter of whittling. Finish up with sandpaper. Then give the ladle as many coats of bacon fat as it will absorb. After that, wash it in hot water and try it out on a good mulligan stew. Of the sketches shown at the top of the page, all but the center ladle were made by Indians. Larger ladles were used for cooking and dishing out foods.

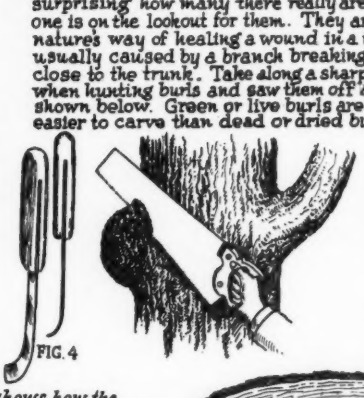


FIG. 4

Fig. 4 shows a knife with the end of the blade bent in a curve, for carving out bowls, ladles, etc.

As burls usually have a somewhat curly grain, a very sharp gouge should be used, gouging out in the same manner as shown in Fig. 3. The thickness of the walls of a large bowl should be about 3/8 or ½ inch and the wall of a drinking cup should be from 3/16 to ¼ inch.

Fig. 6 shows how the burl may be clamped in a vise while carving. When the sides begin to give, take it out of vise.

The only work necessary on the outside of burl bowls or cups is to even up any irregularities and to cut the bottom flat so they can be set down. Fig. 7.

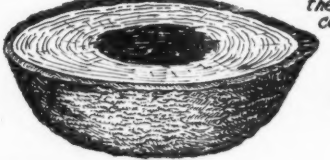


FIG. 5

Fig. 5 shows a burl after it has been sawed off. In many instances the center portion contains a partly rotted end of a broken branch. This makes it so much easier. If the bark is quite even, leave it on until the bowl is roughed out. If it isn't even, remove it, as there might be a bad spot in the burl itself, which means the wound in the tree hasn't been healed over completely, and the burl will not make a good bowl or cup.

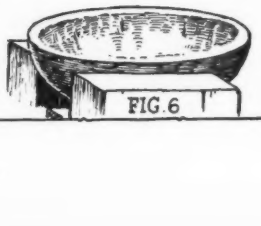
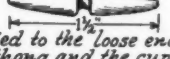


FIG. 6

Drinking cups can be shaped like the ones shown above, and a cord or leather thong inserted in a hole bored thru the lip. A small crosspiece of wood

FIG. 7



is tied to the loose end of the thong and the cup may be hooked or fastened to one's belt while hiking, where it will be handy at all times. Cups and bowls made of burls need not be finished in any way other than smoothing with sandpaper.

A spoon gouge is a handy tool for carving out bowls

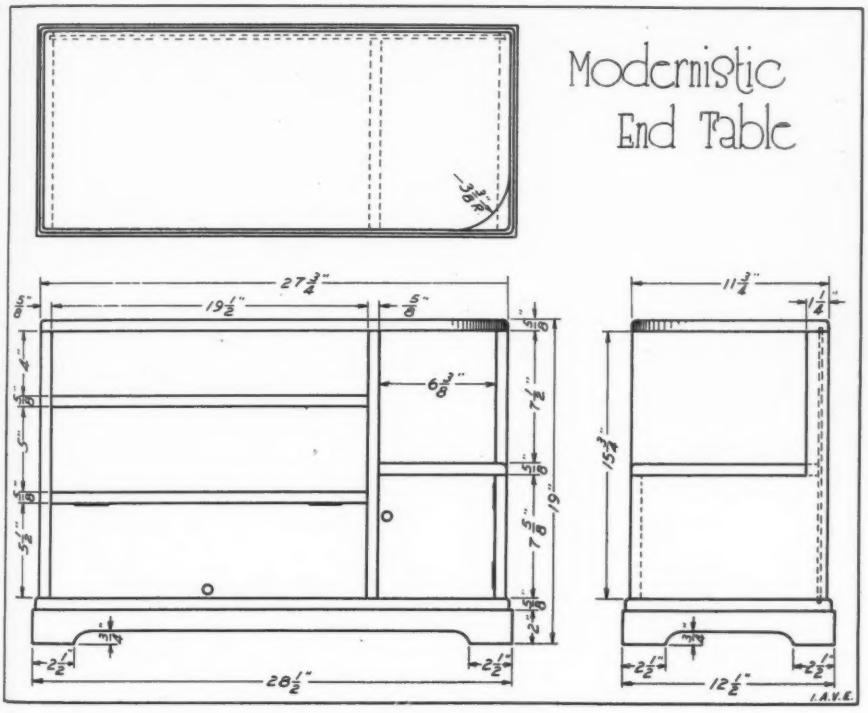
A PRACTICAL MODERNISTIC END TABLE

S. H. Puehler, Public Schools, Milwaukee, Wisconsin

The end table shown herein is up to the minute in design, and it is very practical. It has sufficient capacity to accommodate many of the current periodicals and newspapers, and fulfills the need of an end table.

The upper shelf is made specifically for accommodating the daily newspaper. The center section is for standard-size magazines such as the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION MAGAZINE or *Popular Mechanics Magazine*. The two compartments enclosed by doors may be used as a storage place for a variety of items. The open corner shelf is for the exhibiton of some kind of knicknack such as the candleholder shown. When the table is placed at the arm of a chair or davenport, it becomes a practical and useful addition to any living-room setting.

Modernistic end table



PORTABLE TOOL RACK

Wilbur Hilliard, Samuel Gompers Industrial High School, New York City

This tool rack has the advantage that it can be moved readily from one room to another. The legs are hinged so that they can be raised after the rack has been wheeled into place and fastened to a wall or to the lockers. Each leg is provided with a hook so that it can be held out of the way after the rack has been placed.

Portable tool rack

ROUND TRAY

William J. Becker, Junior High School, Ithaca, New York

This small tray, made from either copper or aluminum, can be used for a number of purposes. It makes a convenient tray for candy. However, it may be used for pins, cards, or as an ash tray. The *success* of a good

FOR YOUR BULLETIN BOARD

POSTER 85 **SEPTEMBER, 1937**

LEADERSHIP

An individual who can work independently, is competent in thinking and acting, and possesses self-reliance, has the outstanding characteristics of a leader.

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Submitted by Professor L. M. Roehl, Cornell University, Ithaca, New York

job depends upon the careful forming with a raising hammer.

Materials required:

1 piece of No. 22-gauge copper (or No. 18-gauge aluminum) 5½ by 5½ in.

Directions:

1. Make bill of material and have instructor approve.

2. Cut material to size (5½ by 5½ in.—*not round*).

3. If copper, anneal by heating to a red heat and quench in cold water. (If aluminum, see instructor.)

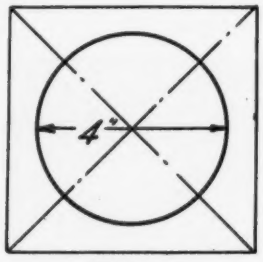

FIG. 1

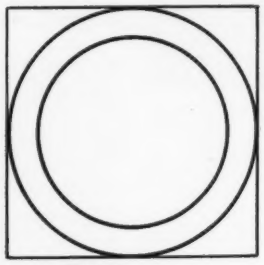
FIG. 3

FIG. 5

4. Locate center of stock as in Figure 1 by drawing diagonals with *pencil*. With dividers, draw a *light* circle 4 in. diameter.

5. Get raising block of correct shape; check with instructor.

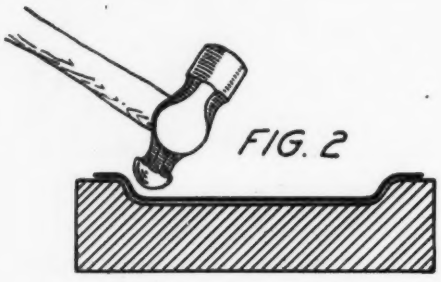
FIG. 2

6. *Scribed circle of tray must always be directly over hole in block.* Make sure of this by marking pencil marks around the four sides of the block as guide lines.

7. Start forming copper to shape. See Figure 2. Be careful of the following:

a) Check type of hammer with instructor.
b) Keep edge of tray flat; use mallet.
c) Strike near edge of depression in forming block only. Hit toward you with hammer tipped at angle shown.
d) Work around edge of tray, *gradually*. Do *not* try to drive into position with a few blows.
e) As the copper gets hard because of pounding, keep annealing it as directed in paragraph 3.

8. When tray is smooth and formed to shape as much as possible in this block, it can

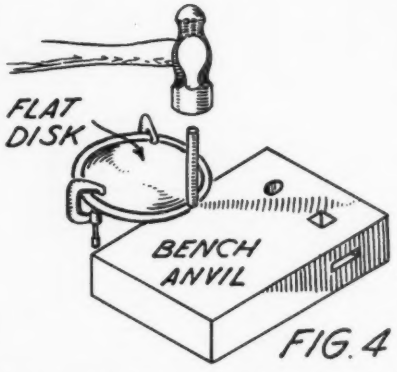

FIG. 4

be deepened still more, if desired. Place in iron form and work in same way as before. Check form, hammer, and mallet with instructor.

9. If you want to ornament this tray through peening, select correct-size hammer and peen inside, holding the tray flat on flat-iron stake or anvil.

10. Reshape bottom; use form if necessary.

11. Set dividers for largest circle possible on your piece of metal. Find center of tray as in Figure 3 and scribe circle. Cut out circle and smooth with file, if needed.

12. Get sheet-metal disk ¼ in. smaller in diameter than tray and clamp in position as in Figure 4. Place tray on flat stake or anvil.

13. Get correct punch from instructor. Punch design around edge of tray as in Figure 4 after you have found out how to perform this operation.

14. Remove disk and clamp a smaller one to it. It should fit about half way on the rim as indicated by the dash-dot line in Figure 5.

15. Secure proper design punch from instructor and, as before, ornament around this line.

16. Clean the copper project by dipping in acid solution. Keep there until most of black is removed. Clean off remainder of black oxide with steel wool, avoiding finger marks.

17. If job is to be polished, do so on buffing wheel.

18. If copper project is to be colored put into liver-of-sulphur solution until desired color is reached. Rinse with water and blot dry or dry in sawdust barrel.

20. Polish lightly with a clean cloth and give a coat of lacquer to preserve finish.

References

A. *Home Workshop Manual,* Wakeling Popular Science Publishing Company, New York City.
B. *101 Metal Working Projects,* Petersen, Bruce Publishing Company, Milwaukee, Wis.
C. *Art Metal Work,* Payne, Manual Arts Press, Peoria, Ill.
D. *School and Home Workshop,* Schultz and Schultz, Allyn and Bacon, Boston, Mass.
E. *Essentials of Metal Working,* Berge and Wing, Manual Arts Press, Peoria, Ill.

Questions

1. Tell how the various sheets of copper are designated. Reference D, page 192.
2. What is the property of metal that

(Continued on page 11A)

FOR YOUR BULLETIN BOARD

POSTER 86 **SEPTEMBER, 1937**

A SELF-STARTER

To accomplish any purpose, one must have the ability to start with what one has at hand, and guide or drive himself to reach a desired completion.

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Submitted by Professor L. M. Roehl, Cornell University, Ithaca, New York

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(Continued from page 308)

allows it readily to be formed into a tray or bowl? Reference E, page 67.

3. Give the property of a metal which permits it to be stretched, such as drawing a wire. Reference E, page 67.

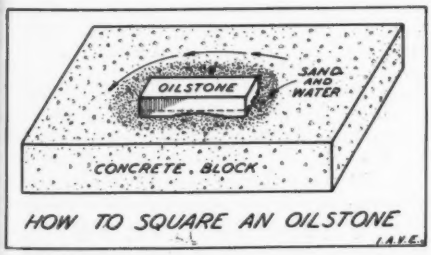
4. Pounding copper causes it to stiffen and become hard. How can this be relieved? Reference C, page 74.

5. Tell how the black oxide that forms on copper which has been heated, can be removed. Reference C, page 98.

RESURFACING AN OILSTONE

A. C. Andrews, Supervisor Industrial Training, Senior High School, Greenfield, Texas

The method of resurfacing oilstones described herewith has been found very effective. A smooth concrete block should be



HOW TO SQUARE AN OILSTONE I.A.V.E.

chosen, then with sand and water placed on its surface, the stone to be resurfaced is rubbed over it with a circular motion. This method trues up the oilstone rapidly and efficiently.

Answers to Questions

MAPLE FINISH ON WHITE WOOD

985. Q.: I have a piece of furniture that is made of white wood, and I would like to finish it in a maple finish. Can you please tell me what I can use to get this finish? — *F. H. T.*

A.: Several colors are typical of the maple finishes: Honey, amber, antique, etc. The first is a real golden shade of fine fire and depth of great clarity. Amber is much duller and browner. Antique is a direct combination of the two. In addition, there are several of the newer shades in the so-called "provincial" finishes. You will see, therefore, that this is rather a large order to "finish the white wood in a maple finish."

However, I will give the method for the honey maple and suggest the others. First, the wood must be sponged with clean water, dried, and sanded very close and smooth, since maple finishes are very thin and essentially a part of the wood. Following the sanding with a 4/0 garnet finishing paper, dust off and apply a coat of water stain made from ½ oz. of potassium dichromate and ½ oz. acid aniline yellow, W.S., dissolved separately in ½ gal. of hot water and then equal quantities of each mixed just previously to application as a stain. Let dry and then give a coat of 2 lb. shellac made up half white and half orange shellacs, reduced with an equal volume of alcohol. To this amount add an equal amount of shellac-mixing lacquer, for better sanding and waterproofing. When dry, sand with a split 6/0 paper, dust off and apply a coat of 4-hour varnish. Let dry overnight, sand with old split 6/0 paper, and after dusting off, recoat with varnish. Dry 3 days, then rub out with felt pad, crude oil, and FFF pumice stone. While the rubbing sludge is still on the work, make up a pad of clean white-cotton waste, wring out of water and then use as a rubbing pad to rub out the work carefully for finish. Clean off with clean soft rags in the direction of the rubbing.

For the amber and antique finishes, add such amounts of standard walnut water stain as will give the desired shade after some experimenting. — *Ralph G. Waring.*

VARNISH REMOVING DIP

986. Q.: We would like to locate the name of a manufacturer of a varnish remover of the type that is placed in a tank and the furniture dipped to remove the varnish. This material is available and is capable of removing the varnish from an ordinary chair or desk when immersed in from ten to thirty seconds. — *F. M. H.*

A.: Write to the Schalk Chemical Co., 348 E. Second St., Los Angeles, Calif., or to the Oakley Chemical Co., Bush Terminal Bldg., New York City. Either firm will make up a safe stripping solution which will not be dangerous to use. — *Ralph G. Waring.*

PAINT ON GLASS

987. Q.: We want to paint some transoms to keep out the bright sunlight, but cannot find any paint that will stay on glass very long without coming off. Could you suggest what to do? — *E. W.*

A.: This presents a difficult problem, especially when you do not tell me where the transoms are located and what are the operating conditions of moisture arising from dipping tanks or other sources. Do you want an entirely opaque coating or do you want translucency, and if so, what color light do you need? After you have decided upon these factors, send your request to Wayne B. Fuller, Technical Director of Pratt and Lambert Co., 79 N. Tonawanda St., Buffalo, N. Y., and he will be able to supply you with a correctly formulated material. — *Ralph G. Waring.*

PREVENTING BLEEDING

990. Q.: I am building a model Napoleonic coach, using a pattern pine for the body. I built one last year out of the same material and was disappointed to find that pitch or rosin came through the finish. I have been unsuccessful in trying to find any of this wood that is free from this defect. I tried orange shellac as an undercoater and also a special undercoater called Dux, put out by du Pont, but neither seemed to check it. Could you suggest a method that would correct this trouble? — *L. G.*

A.: The proper sizing material for a surface of this kind is one which is neutral to both the resinous sap content and any subsequent finish applied over the sizing. Satisfactory results may be had by making up a very thin glue, almost watery in consistency, from any casein glue like Casco. Let dry overnight and then sand with a split 6/0 garnet finishing paper which has been dampened on the back and well crumpled to soften. Dust off and proceed to finish as desired. In case the sand work has cut through at any place, it should be touched up with some more size and a fine-haired brush. — *Ralph G. Waring.*

SHELLAC-MIXING LACQUER

991. Q.: One of the boys in the shop is making a bedroom set of ribbon-grained tanguile and desires a walnut water stain put on it. What would be best to use for this? Where can "shellac-mixing lacquer" be obtained? — *R. V. L.*

A.: The Murphy Varnish Co., of Newark, N. J., manufactures the shellac-mixing lacquer and the proper nonraising water stain of such color as you may desire. For finishing the tanguile, it is suggested that you use either brown mahogany, Adam brown mahogany, antique mahogany, or walnut. Follow the manufacturer's directions for manipulating the stain.

In spite of the nonraising features of the stain, it is urged that the completed cabinetwork be freely sponged with clean, warm water since tanguile is notorious for its grain-raising propensities Let dry in a warm room overnight and then sand clean and true with a "hard" felt block and 4/0 split garnet paper. Stain as per directions on the package; dry; seal with the shellac-mixing lacquer; dry; sand with a split 6/0 garnet paper; fill with a 16-lb. silex-base filler and dry 48 hours in a warm room; varnish with a 4-hour varnish; dry 24 hours; sand with split 6/0 garnet paper; revarnish; dry 24 hours, water-sand with 6/0 wet-or-dry paper; dry overnight; revarnish; dry 3 days; oil-rub with crude petroleum oil, FFF pumice stone, and felt. Clean off the rubbing sludge with a wad of clean waste which has been lightly wrung out of water and then used as a final rubbing to clean up to the perfect "satin" finish that is so much desired. — *Ralph G. Waring.*

VENEERING WALNUT ON CEDAR

1000. Q.: Please advise what precautions are necessary in veneering walnut on cedar. In the case of a walnut-veneered cedar chest, is the core cedar, face veneer walnut, and veneer backing of cedar? If this is true, where is it possible to purchase 1/28-in. cedar for backing? — *W. F. W.*

A.: It is not practical for you to attempt to veneer cedar with walnut. In the first place, red cedar cannot be successfully cut 1/28 in. because of the knots; secondly, such a liner would be worthless for a chest because the wood would quickly lose its essential oil. My recommendations would be for you to purchase 5/16 or 7/16-in. plywood with a figured-walnut face veneer, make up the chest complete and then line it with slip panels of solid cedar held in place with suitable quarter-round or other profiled moldings as your layout may call for. Stock for these panels may be resawed from 1-in. stock and the two inside faces matched face out to give a balanced figure which can then be used attractively in the various panels exposed to view. After assembly, do not apply any finish to the inside liner, in order that a fresh surface may be exposed yearly by a light sanding, and thereby renew the odor of the fresh wood.

Supply houses advertising in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION can supply you with all the necessary materials delivered to your order. — *Ralph G. Waring.*

Association News

SIXTEENTH CONFERENCE ON PRINTING EDUCATION

The sixteenth annual conference on printing education, sponsored by the National Graphic Arts Education Guild, was held June 28 to July 1, at the Knickerbocker Hotel, Chicago, Ill.

The meeting opened on June 28, with a talk by Mr. Douglas C. McMurtrie, of the Ludlow Typograph Company, who discussed the subject, "Printing: Ancient and Modern." Mr. J. L. Frazier, editor of *Inland Printer*, also spoke, giving his personal opinions on the teaching of printing in the schools.

"New Developments in Graphic Arts Education" was the subject for the Tuesday morning session, led by Fred J. Hartman. C. Benson Hurst, Cleveland, Ohio, presented the 1937 Guild Research Project. A booklet, *Suggested Outlines for Courses in Printing*, was issued by the Research Committee on Printing of the Michigan Industrial-Education Society.

Four group sessions were held, including one for vocational and technical schools, one for senior high schools, one for junior high schools, and one for colleges and universities.

The Wednesday morning session was under the direction of John A. Backus. "Type and Typography" was discussed by Sol Hess, associate art director of the Lanston Monotype Machine Company. "Paper," by Kenneth Hunt, Hamilton, Ohio; "Color and Ink," by Dr. L. M. Larsen, and an address by A. G. Fegert on "Equipment and Processes."

The Conference Dinner, under the direction of Harold E. Sanger, of Chicago, was an interesting affair.

Major Frank L. Beals, of Chicago, pointed out that secondary education must change from the old college-preparatory type to a more practical type of education. Harry L. Gage, of the Mergenthaler Linotype Company, in his talk said that printing teachers must sell their subject to industry and to school administrators. Fred J. Hartman called attention to the fact that there is no movement in any other industry like that of the National Graphic Arts Guild. He urged the support of the 32,000 printing establishments of the country.

Reports of the local guilds were presented by representatives from New York, Los Angeles, New Jersey, Southern California, Kansas, Wisconsin, and central guilds.

The first session on Thursday morning consisted of a long report on the activities of the guilds and schools during Printing Education Week last year. This celebration is held in January each year all over the country.

Under the able direction of Harold H. Kirk, Washington, D. C., a good program was held on a "Symposium on Student Clubs," the theme of which was "Developing Student Interest Through a National Club Program." A program of seven speakers was arranged as follows: E. S. French, Washington, spoke on "Keeping an Eye on Objectives"; E. S. Brown, East Chicago, Ind., on "Why Boys Like Club Work"; Edward W. Kurtz, Detroit, Mich., on "Interest Through Club Activities"; Frank Di Giacomo, Washington, on "Maintaining Interest Through Tours"; H. G. Crankshaw on "The Club and Shop Paper"; R. R. Karch, Pittsburgh, on "The Club Paper and What It Does for Boys."

Through the generosity of the American Type Founders Company, prizes in the form of books on printing were awarded to contestants in the Graphic Arts Society's scrapbook contest.

After the closing address by Allan Robinson, president of the Guild, the 1937 yearbook was presented to the members. Each delegate to the conference received a keepsake in the form of a booklet, printed by Mr. Lauck, entitled *Type Revivals: An Exposition Regarding Independent New Designs*, by Frederic W. Goudy.

The officers elected for the year 1937–38 were as follows: president, Harold G. Crankshaw, Washington, D. C.; vice-president, David Gustafson, Chicago, Ill.; secretary, Ferdy J. Tagle, New York, N. Y.; treasurer, C. Harold Lauck, Lexington, Va.; educational director, Fred J. Hartman.

The executive board is composed of J. Henry Holloway, New York, N. Y.; John A. Backus, Elizabeth, N. J.; Harry L. Gage, Brooklyn, N. Y.; Allan Robinson, Baltimore, Md.; Ralph W. Polk, Detroit, Mich.; R. Randolph Karch.

Personal News

¶ MR. DONALD MCCULLEY has been appointed instructor in mechanical drawing in the senior high school at Ashland, Ky.

(Continued on page 15A)

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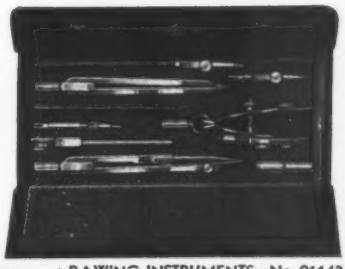

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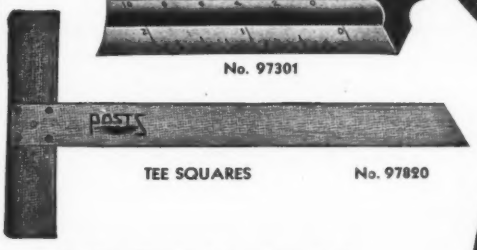

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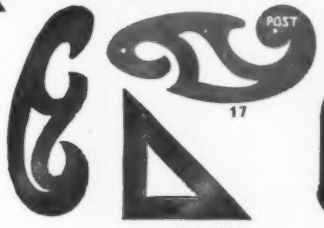

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(Continued from page 12A)

¶ Mr. Arthur B. Wrigley has been appointed supervisor of trades and industries for the New Jersey State Department of Education. Mr. Wrigley was formerly principal of the Elizabeth Boys' Vocational School.

¶ Mr. Grove Sollenberger, of Carlisle, Pa., has been appointed instructor in industrial arts at Schuylkill Haven.

¶ Mr. Claude A. Bosworth has been appointed director of the vocational department in the high school, Grand Haven, Mich.

¶ Mr. Raymond Johnson has been appointed director of vocational rehabilitation at Tulsa, Okla.

¶ Mr. L. F. Graffis has been appointed in the new trades department just opened at Mandan, N. Dak.

New Publications

Books That May Be of Interest to Shop Teachers

Mathematics

Descriptive Geometry

By C. H. Schumann, Jr. Cloth, 336 pages, 6¼ by 9¼, illustrated. Price, $2.75. Published by the D. Van Nostrand Company, Inc., 250 Fourth Ave., New York City.

Mathematics for Everyday Use

By John C. Stone and Virgil S. Mallory. Cloth, 532 pages, 5½ by 7⅝, illustrated. Price, $1.28. Published by Benj. H. Sanborn & Company, 221 East 20th St., Chicago, Ill.

Mathematics for Technical and Vocational Schools

By Samuel Slade and Louis Margolis. Cloth, 517 pages, 5½ by 7⅞, illustrated. Price, $2.50. Published by John Wiley & Sons, Inc., New York City.

Practical Mathematics

By N. J. Lennes. Cloth, 400 pages, 5½ by 8, illustrated. Price, $1.20. Published by The Macmillan Company, New York City.

Second-Year Algebra

By Howard B. Kingsbury and R. R. Wallace. Cloth, 428 pages, 5¼ by 7½, illustrated. Price, $1.40. Published by The Bruce Publishing Company, Milwaukee, Wis.

A Second Course in Algebra

By N. J. Lennes. Cloth, 390 pages, 5½ by 8, illustrated. Price, $1.68. Published by The Macmillan Company, New York City.

English

English for Today

By Ettie Lee. Cloth, 382 pages, 5½ by 8, illustrated. Price, $1.20. Published by The Macmillan Company, New York City.

High School English — I and II

By Henry S. Canby, Olive I. Carter, and Helen Louise Miller. Cloth, 337 pages, 5½ by 8, illustrated. Price, $1 each. Published by The Macmillan Company, New York City.

Miscellaneous

Elements of Retail Selling

By Paul H. Nystrom. Cloth, 369 pages, 5½ by 8¼, illustrated. Price, $2.40. Published by The Ronald Press Company, New York City.

How to Protect Business Ideas

By William H. Leahy. Cloth, 157 pages, 5¾ by 8⅝, illustrated. Price, $2.50. Published by Harper & Brothers, New York City.

Social Studies Curriculum

Cloth, 478 pages, 6¼ by 9⅛, illustrated. Price, $2. Published by the Department of Superintendence, 1201 Sixteenth St., N. W., Washington, D. C.

Adult Education

Police Educators Series II, Conference Leadership Reports Group 1 and 2, Spring, 1937. Police-Sheriffs' Conference Leadership Reports. Foreman Conference Leadership Reports

Paper, 8½ by 11, illustrated. Published by the Toledo University Summer Session, Vocational Department, University of Toledo, in co-operation with the State Board for Vocational Education Trades and Industries, Columbus, Ohio.

Educators who are interested in conducting conference-leadership courses for police and sheriffs' departments and for some industrial concerns can do no better than study this material just listed.

The combined courses referred to in the foregoing consist of 765 pages of mimeographed material. The material, of course, is so voluminous that more than a nominal price ought to be asked for it, although, as it appears, no stipulated price seems to have been placed on it as yet.

Index to Vocations

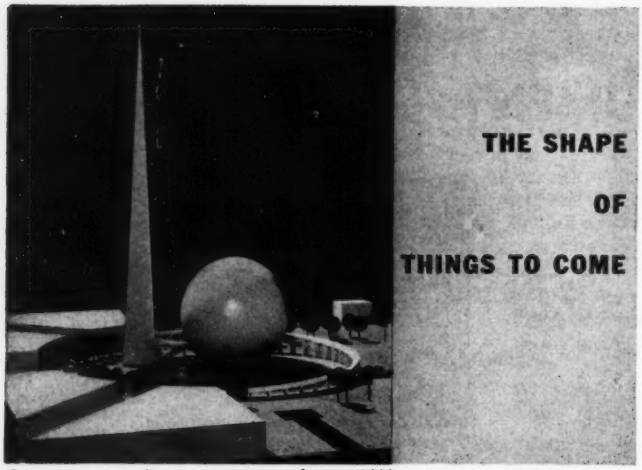
By Willodeen Price and Zelma E. Ticen. Cloth, 106 pages, 6⅞ by 10. Published by The H. W. Wilson Company, New York City.

This index analyzes the occupations in 115 books. The book is divided into an index to vocations, a list of books analyzed, and a list of useful books for vocational and teachers and counselors. In the list of books analyzed, an asterisk precedes those books which in the minds of the authors will be most useful to vocational teachers.

Occupational Guidance

By Paul W. Chapman. Cloth, 632 pages, 5½ by 7⅞, illustrated. Price, $1.76. Published by Turner E. Smith and Co., Atlanta, Ga.

An exceptionally complete book written by a man prominent in vocational work. This book is divided into four parts, the first one devoted to the subject of planning a career; the second to studying representative occupations which are



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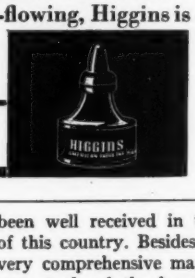

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divided into ten units — agriculture, homemaking, manufacturing, transportation, communication, business, skilled trades, public-service occupations, personal-service occupations, and the professions. The third part is devoted to analyzing the student's interests and abilities, the fourth to preparing for the chosen vocation, and the fifth to finding a job. The appendix lists sources of information for teachers and a list of technical publications which may be found helpful to the young in acquiring occupational information.

I Find My Vocation

By Harry Dexter Kitson. Cloth, 227 pages, 5¾ by 8¼, illustrated. Price, $1.40. Published by McGraw-Hill Book Co., New York City.

This revised edition has been brought up to date. Statistically the list of occupations has been revised and enlarged and a new chapter has been added, entitled "Occupations Change Constantly." The biographical section has also been enlarged very considerably.

Furniture of Yesterday and Today

By Earl Harmes. Cloth, 63 pages, 9 by 12, illustrated. Price, $1.75. Published by The Bruce Publishing Company, Milwaukee, Wis.

The author of this book has made an admirable selection of 23 well-designed pieces of furniture from among the many produced in his classes. Among the articles shown are adaptations from the old masters, as well as examples of the most modern types of furniture.

The illustrations are complete and the descriptions concise and easily understood. The book also contains a chapter on design suggestions and one on wood finishing.

Machine Tool Operation

By Henry D. Burghardt. Cloth, 401 pages, 5⅛ by 7⅝, illustrated. Published by McGraw-Hill Book Company, New York City.

This is the second edition of a book that has been well received in the school machine shops of this country. Besides covering lathe work in a very comprehensive manner, the use of the ordinary tools of the benchworker and layout man are thoroughly explained. Under "Forge Work," the author covers such subjects as soldering, brazing, babbitting, the use of machine steel and carbon tool steel in the making of tools, and hardening and tempering.

Science Training for Metal and Wood Trades

By William H. Dooley, Ph.D., Cloth, 551 pages, 5½ by 8¼, illustrated. Price, $2.40. Published by the Ronald Press Co., New York City.

This is a revised edition of a book published originally in 1919 under the name *Applied Sciences for Metal- and Woodworkers*. It contains eight chapters on mechanics, one on heat, one on light and sound, four on Chemistry, five on electricity, one on strength of materials, one on transmission of power, two on boilers and steam engines, two on heating and ventilating, one on the gas engine, three on patternmaking and foundry work, three on iron and steel, two on machine-shop and sheet-metal practice, one on plumbing and water supply, one on paints and varnishes, and six covering drawing, lumbering, and hand and power woodworking tools and machines.

Educational Psychological and Personality Tests of 1933, 1934, and 1935

By Oscar K. Buros. Paper, 83 pages, 6 by 9. Price, 50 cents. Published by the School of Education, Rutgers University, New Brunswick, N. J.

This helpful booklet was first published on the tests which appeared in 1933–34. The present edition contains a cumulative list including the tests published during 1933–34–35. The information given about each test includes titles, description of the group for which the test was constructed, date of copyright or publication, individual or group test, number of forms, cost, time, author, publisher, references. The booklet also contains a publishers' directory and index, and an index by titles and by authors.

Foundry Work

By R. E. Wendt. Cloth, 240 pages, 5 by 7⅝, illustrated. Price, $2. Published by McGraw-Hill Book Company, New York City.

This book has been revised in order to include recent developments in the production of castings. It consists of four parts, the first one based on fundamental principles, the second on melting and mixing of metals, the third part on bench and floor molding and problems in management, and the fourth part on nonferrous metal founding. The book also contains a glossary of foundry terms and of a number of tables useful to the foundryman.

Mechanical Drafting Handbook

By Frank R. Kepler. Paper, 6 by 9, 141 pages. Price, 60 cents. Published by The Bruce Publishing Company, Milwaukee, Wis.

This is the fourth edition of a handbook that has been found exceedingly useful in teaching mechanical drawing. It has been thoroughly revised both as to text and as to data, in order to make it conform to present-day drafting-room usage. The revisions are based on a survey of drafting-room practices made by the author and on the recommendations of the Committee on Standards for Drawings and Drafting-Room Practices issued by the American Standards Association.

Tables pertaining to lumbering, window and door sizes, and solid-section steel windows and radio and welding symbols have been added.

Wood Carving and Whittling

Prepared by the Editorial Staff of the Popular Science Monthly. Cloth, 270 pages, 5¼ by 7½,

(Continued on page 18A)

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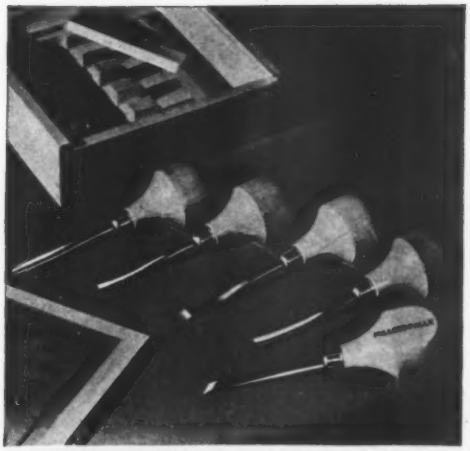

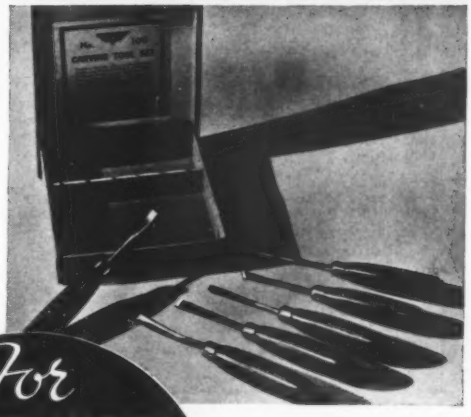

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(Continued from page 16A)

illustrated. Price, $2. Published by The Popular Science Publishing Co., Inc., New York City.

A book for the student, which describes the tools and equipment needed by the carver and the different kinds of wood used by him. Then it gives specific directions for incising level surfaces, carving in relief, pierced carving, carving turned objects, carving animals and human figures. There is also a chapter on designs and patterns and one on sources of ornament. The chapter on whittling is quite interesting.

High-Speed Diesel Engines

By L. H. Morrison. Cloth, 243 pages, 5¾ by 8½, illustrated. Published by The American Technical Society, Chicago, Ill.

The purpose of this book is to acquaint the public with Diesel engines running at speeds up to 2,200 r.p.m. It is especially designed for the prospective owner and operator who need information on the fundamentals of operation and maintenance.

Blueprint Reading for the Building and Machine Trades

By Ben F. Hebberger and Clemens Nicholas. Cloth, 116 pages, 12¼ by 9¼, illustrated. Price, $1.80; key, 25 cents. Published by the McGraw-Hill Book Company, Inc., New York City.

This book was developed to serve as an introduction to mechanical drawing, and also as a text to be used by apprentices and mechanics in various lines of industrial work. The problems are presented in the order of increasing difficulty so that the student acquires, step by step, the skill needed to read involved drawings. No drawing or sketching by the student is required throughout the course, and answers to questions are confined to a single word, letter, figure, or dimension, thus reducing the labor of checking the pupil's work. The work covered contains problems for the machine- and metal-trade groups, and for those engaged in the building-trade groups.

Beginning Mechanical Drawing Units

By William E. Roberts. Paper, 142 pages, 6 by 9, illustrated. Price, 88 cents.

An analysis of the subject of mechanical drawing has been used as a basis for the material presented in this book. The material is divided into 6 units. Unit 1 dealing with drawings of objects involving horizontal and vertical lines only; Unit 2 involving the same types of objects but introducing the invisible edge; Unit 3, objects involving inclined lines; Unit 4, objects involving circles; Unit 5, objects involving tangents; Unit 6, drawings combining the various principles developed in the previous units. There are a number of problems given under each unit so that the material can be adapted to the individual student as well as time limits set for the work in a given school. Related information, supplemented by questions, are made part of each problem.

Marine Electric Power

By Captain Q. B. Newman. Cloth, 159 pages, 5¼ by 8¾, illustrated. Price, $2. Published by Simmons-Boardman Publishing Company, New York City.

A theoretical book on the subject of electricity as applied to electrical appliances used at sea.

Modern Woodworking Machinery

By George F. Cosgrove. Paper, 7¾ by 10¾, 159 pages. Price $2 together with one year's subscription to *Cosgrove's Magazine*. Published by Cosgrove Technical Service, Owosso, Mich.

This book deals mainly with production machines of the kind used in large factories, but also has chapters on machinery layout, routing systems, etc. The various machine types are arranged in family groups and described in separate chapters. The selection is up to the minute, the text clear and well written, and the illustrations numerous. Unfortunately such common machines as hand jointers, band saws, belt, spindle and disk sanders have not been included.

While the book is of special value in helping prospective buyers of woodworking machinery to make their selection, it is also useful to the progressive teacher of woodworking in keeping him posted on the latest developments within the field.

Much of the material has appeared in *Cosgrove's Magazine* within the past two or three years. — *Herman Hjorth*

Elements of Diesel Engineering

By Orville Adams. Cloth, 478 pages, 6¼ by 9¼, illustrated. Published by the Norman W. Henley Publishing Co., New York City.

This is a comprehensive book on the subject written for the men who are preparing to enter the Diesel engineering field. The book contains over 280 illustrations.

News Notes

Establish New Departments

The board of education at Ocilla, Ga., has established new departments in home economics and vocational agriculture. A three-room building will be erected to the present building.

New Vocational Education Plan

The board of education at Portsmouth, Va., has established a vocational course for diversified industries. The course is intended to provide high-school students with practical training in business and industry while attending high school. Students will be given part-time employment to provide the basic training in some line of work which they can follow after they leave school.

(Continued on page 21A)

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(Continued from page 18A)

Trade School in Miami, Fla.

A county-wide trade and industrial school has been established in a remodeled building in Miami, Fla. The building will be used in offering trade and industrial training to pupils in Dade County.

Discontinue Experiments in Aviation

The board of education at West Hartford, Conn., has ordered the discontinuance of experiments with powered airplanes by aviation clubs in the schools. The action was taken in order to relieve the board of responsibility for injured students.

New Trades Course at Mandan, N. Dak.

A new shop has been equipped at Mandan, N. Dak., for giving instruction in general mechanical and electrical trades. The work will be organized on a practical basis to give experience on actual production jobs. Instruction will be offered in automotive repair, gas-engine work, farm mechanics, bench repair, magneto repair, inside wiring, and related technical information. Mr. L. F. Graffis has been appointed instructor in the trades department.

New Practical-Arts Building

The new Practical-Arts Building at the State Teachers' College, Fitchburg, Mass., was dedicated on May 21, 1937. The cost of the building was $23,000. The building is dedicated to the belief that industrial arts is an important subject in the field of general education and that it is of benefit to all boys and to an increasing number of girls.

Craftsman's Guild Competition

Each year thousands of American boys look forward to the Annual Craftsman's Guild Competition, sponsored by the Fisher Body Corporation, in Detroit, Mich. This year, in addition to the contest on an old-style carriage, the firm announced a contest on scale models of automobiles incorporating new and original ideas in automobile-body design.

The contest was governed by rules prepared by the Fisher Body Craftsman's Guild, the educational foundation maintained by the Fisher Body Division of General Motors Corporation. All boys entering the contest were classified according to their age, one group comprising boys from 12 to less than 16 years, and another of boys from 16 to less than 20 years old.

This year's contest, which closed on July 1, presented awards amounting to $47,350, including two four-year university scholarships, 686 state cash awards, and trips to the Guild convention for a junior and a senior from each of the nine regional districts.

One hundred miniature automobiles from boys of the northwestern states were on display in Portland the week of the contest, while four judges selected the state and regional winners. The judges for this region were John Lutz, Detroit; John Reinel, Detroit; F. M. Groshong, Portland; and David Johnson, Portland. The scores were based upon design and artistic merit, scale fidelity, workmanship, practicability of design, painting and color application, proportion and balance of design and parts.

The regional first prize in the senior division was awarded to Ronald Miller, Portland; in the junior division, the honors went to Russell Schnell, Vancouver. Both were given free trips to Detroit.

New Apprentice Program

A new program of apprentice instruction for the various factories in East Aurora, Ill., has been undertaken at the East High School, with an enrollment of fifteen apprentices. Mr. C. I. Carlson, the instructor in charge, is carrying out the program in co-operation with the Fox River Manufacturers' Association.

To fill a demand for workers as a result of the depletion of forces during the depression, the factories are employing from 35 to 40 apprentices, who are employed in the various factories five days a week, and on Saturday morning attend apprentice courses. The classes are held in the East High School for boys living on the east side, and at the West High School for boys living on the west side.

Dean M. M. Willey Warns Against Federal Funds

Dean M. M. Willey, of the University of Minnesota, speaking recently before the annual meeting of the American Association of University Professors, said that the depression had curtailed interest in studies leading to the professional careers, but had aroused greater enthusiasm for vocational and technical training in fields not greatly affected by economic conditions.

Dean Willey warned against federal funds because these appropriations opened the way for the exercise of political influence in the management of schools and caused increased pressure from various political agencies who seek to bend institutions to their own ends.

New Building Course Established

A building trades course has been established in the high school at Chillicothe, Ill., to become effective next September. The course comprises carpentry and the allied trades including electric wiring, concrete construction, painting and decorating, plumbing, and sheet-metal work.

Trade Classes Planned in Anderson, Indiana

The public schools, co-operating with the industries in Anderson, Ind., have worked out an apprenticeship program for training in the trades. Under the plan, apprentices will take up the study of science, mathematics, and drawing as related to the particular trade or industry in which they work. The instructors are men

(Continued on page 23A)

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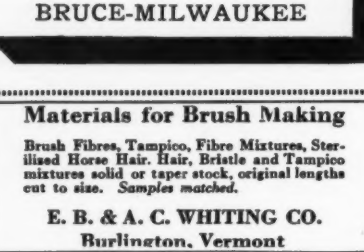

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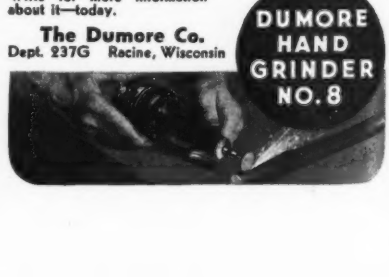

(Continued from page 21A)

from the industry and the public schools. Job analyses will be made by the industrial coordinator to determine the qualifications required to meet definite standards of accomplishment for the five trades to be included in the program.

Establish Machine-Shop Course

The school board of Pittsfield, Mass., has established a machine-shop course in connection with the vocational department of the high school. About $20,000 worth of machinery has been donated to the school department by local industrial concerns.

Add to Industrial-Arts Department

The school board at Newark, Ohio, has voted to add to the industrial-arts training department. A full-time instructor has been employed and new equipment purchased.

New Industrial-Arts Program

The board of education at Fostoria, Ohio, has established a new industrial-arts program, which involves the addition of new equipment estimated to cost $1,800. The new department is intended for students who desire to pursue a trade instead of the general academic course. It will offer instruction in electricity, metalworking, printing, machine-shop work, and photography. Students may take tryout courses before finally selecting the one they wish to pursue. They may also major in an industrial-arts course if they so desire.

Announce Arc-Welding Prize Contest

The Arc Welding Foundation, Cleveland, Ohio, has issued a special circular, giving the general rules and conditions governing the Foundation's $200,000 arc-welding prize contest. The contest which is being sponsored by the James F. Lincoln Arc Welding Foundation, is intended to stimulate an interest in the study of arc welding.

A total of 446 prizes are offered for papers submitted in the contest. From the 44 subclassifications, 220 papers will be selected to receive first prizes totaling $81,400. A group of 44 papers will be selected to receive prizes totaling $74,800 in the main classifications. From the 44 papers in the main classifications, papers will be selected to receive the four main contest prizes totaling $26,000. Additional prizes to the number of 178 will be presented at $100 each. The winner of the grand prize will receive $13,700. Information concerning the contest may be obtained by writing to The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio.

Honor Pioneer in Industrial Education

The *Annual News Bulletin* of the Washington Industrial-Education Association, recently issued, has been dedicated to Charles R. Frazier, principal of the Edison Vocational School in Seattle, and a pioneer in industrial education in the state. The bulletin is edited by Mr. E. J. Griffin, Spokane.

Enlarging Industrial-Arts Department

The new industrial-arts building at Temple, Tex., was opened in September, 1936, with classes in woodworking, metalworking, automotive work, and drawing. The department maintains a full industrial-arts schedule and plans are being made for employing another teacher and adding new equipment.

International Printing Ink Essay Contest

The International Printing Ink Corporation, 75 Varick St., New York City, N. Y., has announced the winners of prizes in the essay contest sponsored in co-operation with the National Graphic Arts Education Guild.

Prizes in the contest went to printing students in 243 vocational and high schools throughout the United States and Canada. For the three best essays submitted at each school, prize sets of "The Three Monographs on Color" were awarded, together with special certificates of merit. In a number of schools, the prizes were given out during assemblies held in connection with Printing Education Week. The national winner in the contest received a $400 scholarship to Carnegie Institute, a trip to New York, and a job at the International Printing Ink Company when he completes his schooling.

New Industrial-Design Course

A new course in industrial design has been established in the art department of the College of Fine and Applied Arts in the University of Illinois, through which it is planned to give students a firm grasp of the principles of design and develop speed and resourcefulness in expression. It will also form a basis for adapting the student's knowledge and creative abilities to the conditions under which designers must work in industry.

Propose New Junior Trade School in Detroit

The board of education of Detroit, Mich., has proposed the erection of a junior trade school for the west side. The George Junior Trade School serves the east side of the city.

Favor Trade School in South Chicago

The Chicago city council has adopted a resolution to consider the establishment of a trade school in South Chicago. The proposal was initiated by industrial leaders, educators, business men, and labor leaders. A group representing all the various trades and businesses had previously asked the board of education and superintendent to include in the 1937 program a trade school for South Chicago.

The plan contemplates taking a boy after graduation from grade school and putting him through two years of academic training and two

(Continued on page 25A)

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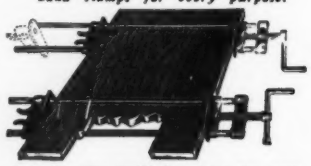

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(Continued from page 23A)

years of training in one of the basic trades. He would then work in one of the industrial plants, continuing postgraduate work in his trade for a certain period.

Forest Conservation in Western Pines

The Western Pine Association of Portland, Ore., has issued a 24-page booklet, giving a pictorial story of the forestry work now being carried on by members of the association. The booklet tells what the western pine industry is doing to keep its lands productive and to assure western communities of a stable forest resource.

Monographs on Trades and Professions

Principals and teachers in the vocational departments of public schools will be interested in a new circular describing clearly and concisely the Commonwealth Monographs dealing with 50 different trades and professions. Any two of these monographs may be obtained free by addressing the Commonwealth Book Co., Inc., 241 Railway Exchange Bldg., Chicago, Ill.

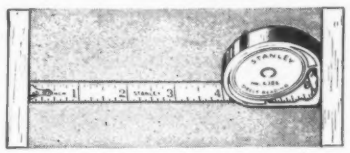
Structural Clay Products Institute

Aggressive and persistent activity of vocational directors in placing greater emphasis on pre-apprenticeship training and on better selection of apprentices, says William F. Patterson, of the Federal Committee on Apprentice Training, will have tremendous effect on American youth. Indications are that industry will lend strong support to the vocational training program. In this direction, the Structural Clay Products Institute, of Washington, D. C., has established a vocational program with its own director to assist in the teaching of masonry as a craft. Courses are being offered for the purpose of turning out thoroughly trained apprentices in masonry. The plan has met with considerable success. New methods of construction are being studied and the latest information resulting from the work of engineers and architects is being used.

School-Shop Equipment News

NEW STANLEY DIRECT READING RULE

The new Stanley No. 6386 "pull-push" rule, manufactured by Stanley Tools, New Britain, Conn., has a direct reading feature for inside measurements. The flexible-rigid steel blade has a white enamel surface against which the black graduations stand out. The blade is graduated in inches and sixteenths on both edges for the entire length.



Direct-Reading Rule

The No. 6386 rule has all of the refinements of the Stanley rules, and is a handy watch-size tool for measuring straight distances, circumferences, irregular shapes, and for outside as well as inside measurements. Each rule is packed in a convenient box. Complete information about this new Stanley rule will be furnished upon request.

ANNOUNCE NEW SHOP TYPEWRITER RIBBON

The new opaque shop typewriter ribbon, recently put out by the Ozalid Corporation, 354 Fourth Ave., New York, N. Y., is a dense ribbon intended exclusively for photo-reproduction work.

The Ozalid typewriter ribbon provides clearer, cleaner, and sharper reproductions of typing and obviates the necessity of the usual carbon backing. It is ideal for making master copies from which white prints, blueprints, photostats and photo-engravings are to be made.

The Ozalid typewriter ribbon is useful also in making out bills of materials, specifications, and other data which must be duplicated accurately and quickly. Complete information will be furnished upon request.

Sanderplane

NEW MODELS OF AMERICAN SANDERPLANE

The new American Sanderplane, manufactured by the American Floor Surfacing Machine Company, Toledo, Ohio, is a portable, electrically driven, perfectly balanced belt sander, for wood, metal, stone, and marble sanding applications. This belt sander is not only used for normal sanding and planing operations, but is capable of doing many jobs formerly impossible. It is manufactured in two different models. Model No. 3 is equipped with a highly efficient built-in dust-collecting system.

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American Saw Mill Machy. Co.....5A
American Technical Society.....18A
Armstrong Bros. Tool Company.....24A
Atkins and Company, E. C.....1A
Atlas Press Company, The.....2A

Badger Electrotype Company.....24A
Baltimore Teachers Agency, The.....22A
Behr-Manning Corporation.....6A
Boehm Bindery, The.....22A
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Boyle Company, A. S.....25A
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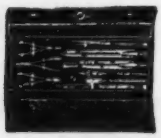

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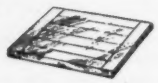

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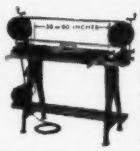
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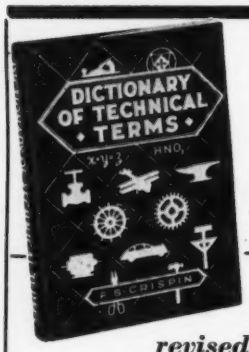

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